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3 WORLD-MODELS

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AN ACCELERATING UNIVERSE IN A STATIC NO-HORIZON TIME-SPACE

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ABSTRACT

3 related world-models, all based on *creatio continua*, and subject to absolute and universal time, are presented in agreement with the principle of conservation of energy; (one of) these models may be able to resolve the problems posed for the ΛCDM-model by the new JWST findings!

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KEYWORDS

Cosmic Time, Continued Creation, Energy Conservation
No Horizon, No Inflation, No Multiverse, No Dark Mysteries

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INTRODUCTION

That it is viable to defend the classical concept of an *absolute or universal time* $\mathcal{T}$, in direct opposition to Einstein, is argued by the British physicist P. Rowlands, [2007], who claims that such time can be identified with what he calls: *the unique birth-ordering of non-local quantum events*. In agreement with this position, he also insists that physics should be reconstructed on the foundation of time-invariant laws.

Sharing his view, I shall here submit a brand new theory of *Creatio Continua* (CC). Any such theory, recognizable by a Hubble factor $\mathcal{H} = \dot{\mathcal{R}}(\mathcal{T})/\mathcal{R}(\mathcal{T})$ that is (or at least tends to become) constant, should conform to the basic results of *Special Relativity* (SR). In SR, as shown by A.A. Ungar [2008], *velocity space* is hyperbolic; hence, with $\mathcal{H}$ being (or tending to become) constant, we shall postulate *position space* to be hyperbolic too. This accords very well with the view of V. Varićak [1924] and J.F. Barrett [1994].

So, using $c \equiv 1$, and taking $r_o \equiv t_o$ as units, we get the non-standard metric:

$$d\mathcal{T}^2 = dt^2 - dr^2[c^{-2}] - [t_o^2]\,sinh^2 r\,(d\theta^2 + sin^2\theta\,d\phi^2) = \textit{invar.} \quad (1)$$

With $\mathcal{R} \equiv 2\,[r_o]\,tanh\frac{r/2}{[r_o]}$, this *universal time-space* is easily translated into an observer's *individual space-time*, corresponding to the well-known (incoming) light-cone of SR:

$$[c^2]\,dt^2 = [c^2]\,d\mathcal{T}^2 + \{d\mathcal{R}^2 + \mathcal{R}^2(d\theta^2 + sin^2\theta\,d\phi^2)\}/(1 - \frac{\mathcal{R}^2}{4[r_o^2]})^2 \quad (2)$$

The space of this space-time differs from SR space by its hyperbolic geometry. When depicted in flat space as an observable *pseudosphere* of radius $\mathcal{R} = 2$ for infinite r, it shows an apparent shrinking of objects with light-time distance $r = c\,t$ from a central observer, proving that none of its contents are hidden behind a cosmic curtain or horizon. In this way it obeys the *no-horizon principle* of the British mathematician E.A. Milne.

Adopting the basic idea of Milne's *Kinematic Relativity* (KR) [1952], which was later confirmed on more general terms by his collegue, the cosmologist A.G. Walker, viz., that *gravity* is not universal, as claimed by Einstein and embodied in the Λ-FLRW model, but is rather the unavoidable *concomitant of local deviations from the global symmetry of a kinematic substratum* (S) *characterized by cosmic isotropy*, we will distinguish between two sorts of *observer-particles* ("Leibnizian monads"): *fundamental ones* (FP) at rest in S, in this context defined relative to CMBR (the cosmic microvawe background radiation), and *accidental ones* (AP), in motion in S, similarly defined with respect to CMBR.

Granted that all FPs constitute an equivalence class S subject to cosmic isotropy, thus making it possible to avoid the "clock paradox" of SR, cf. Milne & Whitrow [1949], we postulate the unrestricted validity of the classical principle of conservation of energy. Now the state of any AP, say A, in S can be described by two simple classical vectors relating to two FPs, say F1 & F2, where A coincides with F1 at the same instant $\mathcal{T}_o$ of $\mathcal{T}$ when A is at rest relative to F2. If F1 ascribes the kinetic energy E to A, F2 must ascribe to A exactly the same energy E, only that E is no longer kinetic but potential, or dynamic. This hints at *a spontaneous rise of potential forces in* S *due to local asymmetries*!

PRESENTATION

Our new ***CC***-world ***W1*** can be constructed as follows, with $c \equiv$ *unity*, $\mathcal{T}$ for FP proper time, $t \equiv \frac{1}{2}(\mathcal{T}_3+\mathcal{T}_1)$ & $r \equiv \frac{1}{2}(\mathcal{T}_3-\mathcal{T}_1)$ for standard coordinates, and postulating:

$$d\mathcal{T} \equiv dt/cosh(r/r_o) = dr/sinh(r/r_o) = \textit{invar.} \quad (3\,a\&b)$$

From these differential equations we derive the following important results:

$$d\mathcal{T}^2 = dt^2 - dr^2 = \textit{invar.} \;.\; v \equiv dr/dt = tanh(r/r_o) \quad (4\,a\&b)$$

$$dt/d\mathcal{T} = 1/\sqrt{1-v^2} \equiv \gamma \;\;.\;\; dr/d\mathcal{T} = v/\sqrt{1-v^2} = v\,\gamma \quad (5\,a\&b)$$

Phipps [1986] opines that γ is the all-important SR-result; and, in the end, what is left of Einsteinian SR & GR is almost nothing but the γ-factor, plus the standard SR-redshift: *

$$1+z(r) = \frac{dt+dr}{d\mathcal{T}} = \frac{d\mathcal{T}}{dt-dr} = e^{r/r_o} \quad (6)$$

We are now able to introduce natural units in accordance with the principle of Milne that *no dimensional constant is allowed to enter the definition of the kinematic substratum*:

$$1+z(r) = e^{r/r_o} = e \;\Leftrightarrow\; r = r_o \equiv t_o \equiv \textit{unity} \quad (7)$$

Our basic differential eq.s $(3\,a\&b)$ are then easily integrated; the result being:

$$\rho = sinh\,r/e^t = 2\,tanh\tfrac{r}{2}/e^{\mathcal{T}} \equiv \mathcal{R}/e^{\mathcal{T}} \quad (8)$$

$$e^t d\rho = cosh\,r\,dr - sinh\,r\,dt = dr - sinh\,r\,d\mathcal{T} \quad (9)$$

The formal difference between fundamental and accidental particles can be stated thus: for fundamental particles (FP), ρ is a constant; for accidental ones (AP), ρ is a variable. It is now easy to verify that our cosmological model is a genuine *Steady State* universe:

$$\mathcal{H} \equiv \dot{\mathcal{R}}(\mathcal{T})/\mathcal{R}(\mathcal{T}) = \textit{const.} \quad (10)$$

From $\dot{\mathcal{R}} \propto \mathcal{R}$ we infer that *position-space* must be *hyperbolic*, just like *velocity-space*:

$$d\mathcal{T}^2 = dt^2 - dr^2 - sinh^2 r\,(d\theta^2 + sin^2\theta\,d\phi^2) \quad (1)$$

This invisible *World Map* is easily translated into an observable *World View:*

$$dt^2 = d\mathcal{T}^2 + \{d\mathcal{R}^2 + \mathcal{R}^2(d\theta^2 + sin^2\theta\,d\phi^2)\}/(1-\tfrac{\mathcal{R}^2}{4})^2 \quad (2)$$

Following Milne's KR, cf. North [1965, p.343 eq.14], we suppose the energy of photons exchanged between FPs to be invariant, their rates of observation being reduced by the standard redshift as well as by the reduction of unit area in hyperbolic space, thus:

$$\mathcal{L}^{-1} \propto (1+z)\,sinh^2 r \propto s\,(s-s^{-1})^2 \quad (11)$$

We are then able to compute the relative luminosities of similar objects at rest in CMBR:

$$\frac{\mathcal{L}_\alpha}{\mathcal{L}_\beta} = \frac{s_\beta\,(s_\beta - s_\beta^{-1})^2}{s_\alpha\,(s_\alpha - s_\alpha^{-1})^2} \underset{s \gg 1}{\simeq} \frac{s_\beta^3}{s_\alpha^3} \quad (12)$$

The number-redshift relation of FPs distributed evenly in hyperbolic space is found to be:

$$\mathcal{N}_{r,\omega} \propto \int_{r_1}^{r_2} sinh^2 r\,dr\,d\omega \propto \int_{s_1}^{s_2} (s-s^{-1})^2 s^{-1} ds\,d\omega \underset{s \gg 1}{\simeq} \int_{s_1}^{s_2} s\,ds\,d\omega \quad (13)$$

* NB: I have to renounce my earlier suggestion that the irreversibility of time is explainable by an asymmetric cosmic redshift: such redshift may characterize a RW-model, but not the present one.

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CONCLUSION

Following Milne, we distinguish between two different descriptions of ***W1***, viz., as *World Map* and as *World View*, where the universal constancy of c in *World View* reflects a "stretching" of light in *World Map*, cf. Prokhovnik [1988]:

World Map**: **an invisible hyperboloid of co-existing objects

$$d\mathcal{T}^2 = dt^2 - ds^2 \;.\; ds^2 = dr^2 + sinh\, r^2(d\theta^2 + sin^2\theta d\phi^2)$$

The hyperbolic space of *World Map* is isotropic and homogeneous; for fixed $\mathcal{T}$, it yields an instantaneous "snap-shot" of the universe.

World View**: **a visible pseudo-sphere of shells of varying age

$$dt^2 = d\mathcal{T}^2 + ds^2 \;.\; ds^2 = \{d\mathcal{R}^2 + \mathcal{R}^2(d\theta^2 + sin^2\theta\, d\phi^2)\}/(1 - \tfrac{\mathcal{R}^2}{4})^2$$

The flat space of *World View* is isotropic, but not homogeneous; with varying $r = [c]\,t$, it depicts "space-shells" of increasing age, explaining the *observed crowding of objects* with distance, see *www.astro.ucla.edu/~wright/stdystat/htm*,fig.$2_{1\text{-}3}$; compare *'Circle Limit iv'* of M.C. Escher [1960], NB!

Two other world models are hinted at below:

***W2**: "A Fierce Blow"*

$$\rho = sinh\, r/sinh\, t = 2\, tanh\tfrac{r}{2}/sinh\,\mathcal{T} \equiv \mathcal{R}/sinh\mathcal{T}$$

$$sinh\, t\, d\rho = cosh\, r\, dr - sinh\, r\, coth\, t\, dt = dr - sinh\, r\, coth\,\mathcal{T} d\mathcal{T}$$

$$\mathcal{H}_2(\mathcal{T}) \equiv \dot{\mathcal{R}}(\mathcal{T})/\mathcal{R}(\mathcal{T}) \propto coth\,\mathcal{T} \underset{\mathcal{T}\to\infty}{\longrightarrow} \mathcal{H}_1$$

***W3**: "A Gentle Flow":*

$$\rho = sinh\, r/cosh\, t = 2\, tanh\tfrac{r}{2} r/cosh\,\mathcal{T} \equiv \mathcal{R}/cosh\,\mathcal{T}$$

$$cosh\, t\, d\rho = cosh\, r\, dr - sinh\, r\, tanh\, t\, dt = dr\, sinh\, r\, tanh\,\mathcal{T} d\mathcal{T}$$

$$\mathcal{H}_3(\mathcal{T}) \equiv \dot{\mathcal{R}}(\mathcal{T})/\mathcal{R}(\mathcal{T}) \propto tanh\,\mathcal{T} \underset{\mathcal{T}\to\infty}{\longrightarrow} \mathcal{H}_1$$

Granted that gravity cannot act as a brake on the socalled expansion of space or, rather, the spreading of the material particles contained within the hyperbolic time-space, it is obvious that only a faint pressure is needed to accelerate a highly natural dispersion. Such pressure might then be produced by an apparent local creation of matter needed to compensate the apparent vanishing of matter at the apparent boundary of the universe.

Realizing that *the pseudosphere* can be viewed as *a cosmic black hole* from which nothing can escape, the necessity of a compensation follows directly from the principle of the conservation of energy which here holds without any proviso, in contrast to GR.

So there is no "dark energy" as there is no "dark matter"; cf. Ungar [op.cit.,p.491f]. As there are no horizons, all objects in the pseudosphere being observable in principle, there is no need for "inflation" either, nor for lofty speculations about a "multiverse".