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Subluminal Evolution and Superluminal Creation of Dark Energy

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Abstract- In an attempt to find an origin of dark energy it is found that the hypothetical pair of gravitationally bound Planckeon of mass $m_{pl} \sim 0.5g$ and the Higgs boson of masss $m_H \sim !0^{-4}\, m_{pl}$ creates a negative attractive potential $-Gm_{pl}m_H/l_{pl}$. The corresponding temperature of thermal creation $T \sim 10^{28}K$ is higher than $T \sim 10^{27}K$ accepted by the standard inflationay cosmology, but within the asymptotic limit $T \sim \infty$ interpolated from Hubble's expansion history to the point origin of the Hubble universe.

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Subluminal Evolution and Superluminal Creation of Dark Energy

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Abstract- In an attempt to find an origin of dark energy it is found that the hypothetical pair of gravitationally bound Planckeon of mass $m_{pl} \sim 0.5$g and the Higgs boson of masss $m_H \sim !0^{-4}\ m_{pl}$ creates a negative attractive potential $-Gm_{pl}m_H/l_{pl}$. The corresponding temperature of thermal creation $T \sim 10^{28}$K is higher than $T \sim 10^{27}$K accepted by the standard inflationay cosmology, but within the asymptotic limit $T \sim \infty$ interpolated from Hubble's expansion history to the point origin of the Hubble universe.

I. Introduction

As an addendum to previous discussions on the signal trasmission in bi-directional EPR correlation, "zizagging against causal wind,"[1] a cosmological implication of magnetic monopole and Higgs boson is discussed by extending the Plankeon model of dark energy to a combined Plackeon-Higgs boson model.

II. Ticking Particle Orbit

Consider a test particle ticking (quantized) with Planck period $l_{pl} = \hbar/m_{pl}c$ and moving on the surface of the Friedman universe. The line element ds of the particle orbit is given in the Friedman-Reisner-Nordstrħom form:

$$\begin{aligned} ds^2 &= c^2g_{tt}dt^2 - g_{rr}dr^2\ \ r^2d\theta^2,\ (g_{tt} = g_{rr}^{-1}) \\ &= [1 - r^2/r_g^{\,2} + L^2/(m_{pl}cr)^2]. \\ &= (1 - r^2/r_g^{\,2} + L^2l_{pl}^{\,2}/r^2), \end{aligned} \tag{1}$$

where

$$\begin{aligned} L &= m_{pl}r^2d\theta/dt, \\ &= l_\theta\hbar/2\pi,\ l_\theta = \text{integer}. \end{aligned} \tag{2}$$

is the quantized angular momentum preventing the universe from gravitational collapse by ticking world lines crossing the time axis of the Minkowki space at $ct = l_{pl}$ at $r = 0$.

III. Superluminal Evolution

The observed velocity of the signal transmission or the light velocity dr/dt is determined by putting $ds^2 = 0$ as

$$\begin{aligned} dr/dt &= c(g_{tt}/g_{rr}) \\ &= (1 - r^2/r_g^{\,2} + L^2l_{pl}^{\,2}/r^2).) \end{aligned} \tag{3}$$

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Starting from quantum fluctuations of preexisting spacetime metric for $0 < r < l_{pl}$, the light velocity is superluminal at $r \sim l_{pl}$. After Big Bang at temperature $T \sim 10^{27}$K, dr/dt decreases with the increase of r towards $dr/dt = c$ at $r_c = (r_gl_{pl})^{1/2} \sim 10^{-2}$cm for $r_g = R \sim 10^{28}$cm. During the superluminal and inflationary epock of electroweak and grand unification of gauge fields by Higgs mechanics, a causally related small region extends from $\sim 10^{-25}$cm to $r \sim 10$ cm followed by a brief interlude of reheating, returning to the pre-inflationary temperature of the universe. Further evolution of the universe is described by the standard Friedman universe starting the radiation dominated phase of Hubble's evolutional history expanding with s subluminal velocity. Hubble constant

$$H = v/d \tag{3}$$

relates the velocty v of a massive extragalactic object to its distance d from the Earth.

IV. Subluminal Evolution

Subluminal expansion and contraction of the Friedman universe is described by the density parameter $\Omega_\Lambda = \rho_\Lambda/\rho_{c\Lambda}$ where ρ_Λ is the constant energy density uniformly filling the universe and $\rho_{c\Lambda}$ is the critical energy density. For $\Omega_\Lambda = 1$ the universe is closed; For $\Omega_\Lambda = 0$ it is empty and flat; For $0 < \Omega_\Lambda < 0.5$ the lower hemisphere filled with dark matter, filled with free Planckeon having positive rest mass energy $m_{pl}c^2$, is open to asymptoically flat outer space through single-valued Schwarzschild throat; For $0.5 < \Omega_\Lambda < 1$ the evolutionarilly earlier upper hemisphere, filled with dark energy, filled with negatiive energy attractive potential $-Gm_{pl}^{\,2}/l_{pl} = -m_{pl}c^2$, is almost closed and joined onto asymptotically flat space through double-valued Schwarzschild bottleneck (Einstein-Rosen bridge); For $\Omega_\Lambda \sim 1$ bottleneck is ticking (pulsating) with Planck period creating Planck scale black hole ouside the event horizon.

V. Mass Defect

During subluminal evolution from $r = r_c$ to r_g, the mass defect develops between Newtonian mass M and the relativistic proper mass M_p calculated from the proper radius $R_p = \int^R g_{rr}dr$:

$$\begin{aligned} M_p &= \rho_\Lambda V_p \\ &= (3/2)(R/r_g)^3\sin^{-1}(R/r_g). \end{aligned} \tag{4}$$

We find that M_p increases with the increase of the world radius from $r \sim l_{pl}$, where $\sin^{-1}(l_{pl}/r_g) \sim 1$, until V_p fills the lower hemisphere of the spherical universe, where $\sin^{-1}(l_{pl}/r_g) = \pi/4$. With further increase of r, R_p decreases towards $R_p \sim l_{pl}$, where $\sin^{-1}(l_{pl}/r_g) \sim \pi/2$, forming a gravitational semiclosure with $V_p \sim 0$ and $M_p \sim 0$, developing Planck scale black holes outside the gravitatioal radius $r = r_g = R$.

VI. Superluminal Particle Creation

The detection in 2014 of Higgs boson of about 100 proton mass using CERN high energy proton-proton collision seems to simulate the particle creation by Big Bang ocuuring near but beneath the equator of the semiclosed Friedman universe dividing evolutionarilly earlier upper hemishere filled with dark energy and lower filled with dark matter with density parameter $\Omega_m \sim 0.5$, joined onto outer space through Schwarzschld throat.

VII. Magnetic Monopole and Nambu's Mass Formula

Recently in June 2016 in Tokyo a successful artificial creation of magnetic monopole, using spin ice of rare earth metalsals, was anounced.[2] The magnetic monopole was predicted by Dirac in 1931 and its neccessary existence was emphasized by t'Hooft and others in the grand unified gauge theory after Big Bang. We here point out that the monopole mass spectrum

$$m_{mono} = n(\hbar c/e), \ n = \text{integer} \tag{5}$$

is hidden in Nambu's mass spectrum[1] for elementary particles discovered before 1952:

$$\begin{aligned} m_n &= n(\hbar c/e^2)m_e, \quad n = \text{integer}, \\ &= (137n/2)\, m_e, \ m_e = \text{electron mass}, \\ n &= 3, 4, 14, 15, 16, 17, 18, 19, 24, 33 \end{aligned} \tag{6}$$

for μ, π, K, τ mesons), P/N (proton/neutron), Λ, Ξ, Ω, Λ_c. The Higgs boson mass is found to be about 100 proton mass. We not that the quantized angular term in the expression of ds^2 represents a monopole. Nambu's mass formula does not apply to Higgs boson requring $n \sim 10^4$.

VIII. Planckeon-Higgs Boson and Dark Energy

Nambu's mass formula (6) is rewrtten as

$$m_n = nGm_{pl}^2/L = n, \quad n \text{ integer}, \tag{7}$$

where $L = \hbar/m_e c$ is the electron Compton wavelength. In the Plackeon model of dark energy, the universe is filled with gravitational Bohr atoms, gravitationally bound pairs of Planckeons, each atom creating negative energy attractive potential $-Gm_{pl}^2/l_{pl}$. We here extend this model and redefine the gravitational Bohr atom as the gravitationally bound pair of a Planckeon and Higgs boson creating a negative attractive potential

$$-Gm_{pl}m_H/l_{pl} \tag{8}$$

where m_H is the mass of the Higgs boson. Being $m_{pl} \sim 0.5g$ and $m_H \sim !0^{-4}\, m_{pl}$, the temperature required for thermal creation is $T \sim 10^{28}$K compared to $T \sim 10^{27}$K accepted by the standard inflationay cosmology, but within the asymptotic limit interpolated from Hubble's expansion history.

IX. Fissionary Big Bang Universe

We have so far discussed a cosmological bi-directional EPR correlation $P \leftrightarrow S \leftrightarrow Q$ between events P and Q sharing a common source at S. In the Big Bang cosmology the inflationary epock lasts from the radius of the universe $r = r_c \sim 10^{-25}$cm ($\sim 10^{-35}$sec) to r = 10 cm). It is thus conceivable that a counter-propagating pair of positive energy uiniverse P and anti-universe Q is created during the inflationary epock. Then the oppositely charged two universes can be causaly related by superluminal signal exchange in PC and T-symmetric way. This model applies to the V-shaped bi-directional EPR correlation of the semiclosed Friedman universe, joined onto asymptotically flat outer space through Schwarzschild bottleneck, the Higgs field sweeping the unified gauge field lines of force extending to infinity through the bottlenec, if the univese is electrically and baryonically charged, in search of oppositly charged universe.

References Références Referencias

1. N. Hokkyo, Physics and Space Science 15(6) 2015.
2. K. Kimura et al. Nature Communications, 17 June, 2016.

Addendum

In Ref.[1] the last term in Eq.(23) should be

$$\int_A^R d\tau = \ldots\ldots \rightarrow \int_A^R d\tau \exp i[(\omega_A + |\omega_B| + \omega_C]\tau \tag{23}$$