Oscillations of the Chromatic States and Accelerated Expansion of the Universe

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It is known (Quznetsov G. Higgsless Glashow's and quark-gluon theories and gravity without superstrings. *Progress in Physics*, 2009, v. 3, 32–40) that probabilities of pointlike events are defined by some generalization of Dirac's equation. One part of such generalized equation corresponds to the Dirac's leptonic equation, and the other part corresponds to the Dirac's quark equation. The quark part of this equation is invariant under the oscillations of chromatic states. And it turns out that these oscillations bend space-time so that at large distances the space expands with acceleration according to Hubble's law.

1 Introduction

In 1998 observations of Type Ia supernovae suggested that the expansion of the universe is accelerating [1]. In the past few years, these observations have been corroborated by several independent sources [2]. This expansion is defined by the Hubble rule [3]

$$V(r) = Hr, \tag{1}$$

where $V(r)$ is the velocity of expansion on the distance r, H is the Hubble's constant ($H \approx 2.3{\times}10^{-18}c^{-1}$ [4]).

It is known that Dirac's equation contains four anticommutive complex 4×4 matrices. And this equation is not invariant under electroweak transformations. But it turns out that there is another such matrix anticommutive with all these four matrices. If additional mass term with this matrix will be added to Dirac's equation then the resulting equation shall be invariant under these transformations [5]. I call these five of anticommutive complex 4×4 matrices *Clifford pentade*. There exist only six Clifford pentads [7, 8]. I call one of them the light pentad, three — the chromatic pentads, and two — the gustatory pentads.

The light pentad contains three matrices corresponding to the coordinates of 3-dimensional space, and two matrices relevant to mass terms — one for the lepton and one for the neutrino of this lepton.

Each chromatic pentad also contains three matrices corresponding to three coordinates and two mass matrices — one for top quark and another — for bottom quark.

Each gustatory pentad contains one coordinate matrix and two pairs of mass matrices [9] — these pentads are not needed yet.

It is proven [6] that probabilities of pointlike events are defined by some generalization of Dirac's equation with additional gauge members. This generalization is the sum of products of the coordinate matrices of the light pentad and covariant derivatives of the corresponding coordinates plus product of all the eight mass matrices (two of light and six of chromatic) and the corresponding mass numbers.

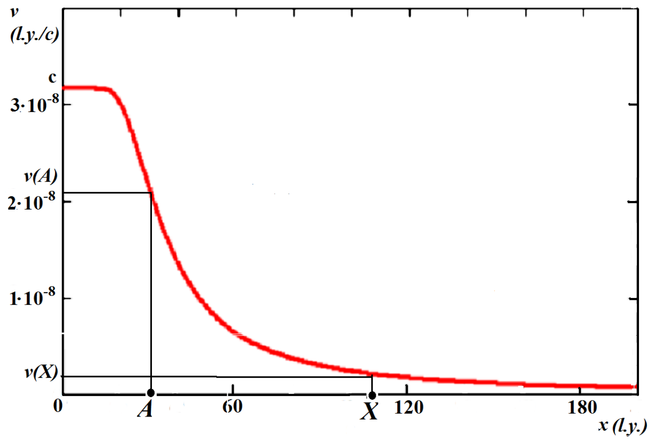

Fig. 1: Dependence of $v(t, x)$ from x [8].

If lepton's and neutrino's mass terms are equal to zero in this equation then we obtain the Dirac's equation with gauge members similar to eight gluon's fields [8]. And oscillations of chromatic states of this equation bend space-time.

2 Chromatic oscillations and the Hubble's law

Some oscillations of chromatic states bend space-time as follows [8]

$$\left.\begin{aligned} \frac{\partial t}{\partial t'} &= \cosh 2\sigma \\ \frac{\partial x}{\partial t'} &= \mathrm{c}\sinh 2\sigma \end{aligned}\right\}. \tag{2}$$

Hence, if v is the velocity of a coordinate system $\{t', x'\}$ in the coordinate system $\{t, x\}$ then

$$\sinh 2\sigma = \frac{\left(\frac{v}{\mathrm{c}}\right)}{\sqrt{1-\frac{v^2}{\mathrm{c}^2}}}, \qquad \cosh 2\sigma = \frac{1}{\sqrt{1-\frac{v^2}{\mathrm{c}^2}}}.$$

Therefore,

$$v = \mathrm{c}\tanh 2\sigma. \tag{3}$$

Let

$$2\sigma := \omega(x)\,\frac{t}{x}$$

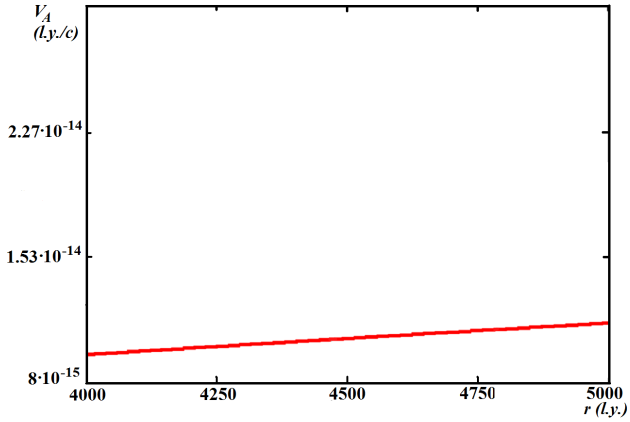

Fig. 2: Dependence of $V_A\,(r)$ on r with $x_A = 25 \times 10^3$ l.y.

with

$$\omega\,(x) = \frac{\lambda}{|x|}\,,$$

where λ is a real constant with positive numerical value.

In that case

$$v\,(t, x) = \mathrm{c}\tanh\left(\frac{\lambda}{|x|}\frac{t}{x}\right). \tag{4}$$

Let a black hole be placed in a point O. Then a tremendous number of quarks oscillate in this point. These oscillations bend time-space and if t has some fixed volume, $x > 0$, and $\Lambda := \lambda t$ then

$$v\,(x) = \mathrm{c}\tanh\left(\frac{\Lambda}{x^2}\right). \tag{5}$$

A dependency of $v(x)$ (light years/c) from x (light years) with $\Lambda = 741.907$ is shown in Fig. 1.

Let a placed in a point A observer be stationary in the coordinate system $\{t, x\}$. Hence, in the coordinate system $\{t', x'\}$ this observer is flying to the left to the point O with velocity $-v\,(x_A)$. And point X is flying to the left to the point O with velocity $-v\,(x)$.

Consequently, the observer A sees that the point X flies away from him to the right with velocity

$$V_A\,(x) = \mathrm{c}\tanh\left(\frac{\Lambda}{x_A^2} - \frac{\Lambda}{x^2}\right) \tag{6}$$

in accordance with the relativistic rule of addition of velocities.

Let $r := x - x_A$ (i.e. r is distance from A to X), and

$$V_A\,(r) := \mathrm{c}\tanh\left(\frac{\Lambda}{x_A^2} - \frac{\Lambda}{(x_A + r)^2}\right). \tag{7}$$

In that case Fig. 2 demonstrates the dependence of $V_A\,(r)$ on r with $x_A = 25{\times}10^3$ l.y.

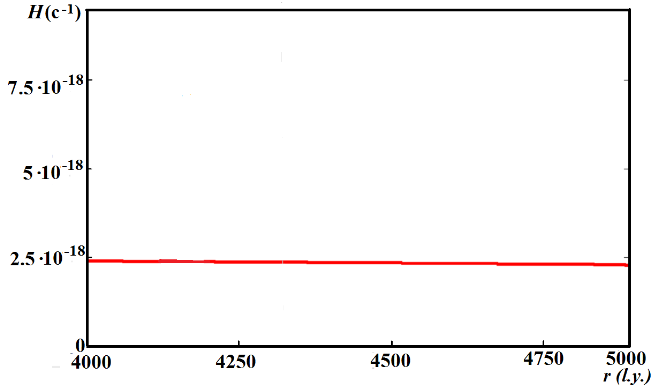

Fig. 3: Dependence of H on r.

Hence, X runs from A with almost constant acceleration

$$\frac{V_A\,(r)}{r} = H. \tag{8}$$

Fig. 3 demonstrates the dependence of H on r (the Hubble constant).

3 Conclusion

Therefore, the phenomenon of the accelerated expansion of Universe is explained by oscillations of chromatic states.

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