NEW COSMOLOGY WITH THE CROTHERS METRIC

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ABSTRACT

It is shown that the Crothers metric for a general spacetime is the only valid metric of line element based general relativity. The equation of motion, orbital equation, deflection of light due to gravitation, and various orbital properties of the metric are evaluated. In general five experiments are needed to determine the unknowns of the Crothers metric, which however does not suffer from the severe internal inconsistencies of Einsteinian general relativity or relativity in a spherical spacetime.

Keywords: ECE theory, cosmology with the Crothers metric.

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1. INTRODUCTION

Recently in this series of papers {1 - 10} it has been shown that the Einsteinian general relativity (EGR) and general relativity in a spherical spacetime suffer from a severe self inconsistency which invalidate them completely as theories of physics. These theories are based on the infinitesimal line element method. In Section 2 it is shown that the Crothers metric of general spacetime does not suffer from this defect, and is a valid theory of cosmology. The equation of motion, orbital equation, light deflection due to gravitation, and various orbital properties are of the Crothers metric are derived in this section. In Section 3 the results are checked by computer and a numerical analysis of the results suggested. In general the Crothers metric depends on five unknown parameters, so five independent experiments are needed to find them. Line element general relativity ceases to be a predictive theory of physics, and this work overturns a century of dogmatism in physics and cosmology.

2. PROPERTIES OF THE CROTHERS COSMOLOGY.

In cylindrical polar coordinates in the plane:

$$dZ = 0 \quad -(1)$$

the infinitesimal line element of Crothers {1 - 10} is:

$$ds^2 = c^2 d\tau^2 = AC^{1/2} c^2 dt^2 - BC^{1/2} dr^2 - C(r)\, d\theta^2 \quad -(2)$$

where A and B are unknown parameters and where C is defined by:

$$C(r) = \left(|r - r_0|^n + \alpha^n \right)^{2/n}; \quad -(3)$$

here R is the radius of curvature and

$$r_0 = \frac{2MG}{c^2} \quad -(4)$$

where G is Newton's constant, M is the attracting mass, and c the speed of light. The parameter α is another unknown and n is an integer. The radius of curvature R is related to the radial coordinate r. If m is the mass of the attracted object the lagrangian from Eq. (2) is:

$$\mathcal{L} = \frac{1}{2}mc^2 = \frac{m}{2}\left(c^2AC^{1/2}(r)\left(\frac{dt}{d\tau}\right)^2 - BC^{1/2}(r)\left(\frac{dr}{d\tau}\right)^2 - C(r)\left(\frac{d\theta}{d\tau}\right)^2\right) \quad -(5)$$

where τ is the proper time. The Euler Lagrange equation shows that the total energy is:

$$E = mc^2AC^{1/2}(r)\frac{dt}{d\tau} \quad -(6)$$

and the total angular momentum is:

$$L = mC(r)\frac{d\theta}{d\tau}. \quad -(7)$$

Both E and L are constants of motion. By definition:

$$d\underline{r} \cdot d\underline{r} = v^2dt^2 = BC^{1/2}(r)dr^2 + C(r)d\theta^2 \quad -(8)$$

so the total velocity of m is defined by:

$$v^2 = BC^{1/2}(r)\left(\frac{dr}{dt}\right)^2 + C(r)\left(\frac{d\theta}{dt}\right)^2. \quad -(9)$$

It follows that:

$$c^2d\tau^2 = \left(c^2AC^{1/2}(r) - v^2\right)dt^2, \quad -(10)$$

$$\frac{dt}{d\tau} = \left(AC^{1/2}(r) - \frac{v^2}{c^2}\right)^{-1/2} \quad -(11)$$

and that:

$$E = mc^2 A C^{1/2}(r)\left(AC^{1/2}(r) - \frac{v^2}{c^2}\right)^{-1/2} \quad -(12)$$

Therefore Eq. (5) is:

$$mc^2 = \frac{E^2}{Amc^2 C^{1/2}(r)} - mBC^{1/2}(r)\left(\frac{dr}{d\tau}\right)^2 - \frac{L^2}{mC(r)}, \quad -(13)$$

and this equation may be rearranged to give the equation of motion of the Crothers metric:

$$\frac{1}{2}m\left(\frac{dr}{d\tau}\right)^2 = \frac{1}{2BC(r)}\left(\frac{E^2}{Amc^2} - C^{1/2}(r)\left(mc^2 + \frac{L^2}{mC(r)}\right)\right). \quad -(14)$$

The orbital equation is obtained using:

$$\frac{dr}{d\tau} = \frac{dr}{d\theta}\frac{d\theta}{d\tau}, \quad \frac{d\theta}{d\tau} = \frac{L}{mC(r)}, \quad -(15)$$

from which it follows that:

$$\left(\frac{dr}{d\theta}\right)^2 = \frac{mC(r)}{BL^2}\left(\frac{E^2}{Amc^2} - C^{1/2}(r)\left(mc^2 + \frac{1}{C(r)}\frac{L^2}{m}\right)\right). \quad -(16)$$

For a distance of closest approach R_0 the light deflection due to gravitation is:

$$\Delta\theta = 2\int_0^{R_0}\left(\frac{mC(r)}{BL^2}\right)^{1/2}\left(\frac{E^2}{Amc^2} - C^{1/2}(r)\left(mc^2 + \frac{1}{C(r)}\frac{L^2}{m}\right)\right)^{-1/2} dr \quad -(17)$$

and depends on A, B, C, E and L. Following upon the collapse of EGR, the light deflection due to gravitation cannot be predicted by general relativity. In general five independent experiments are needed to determine the five unknowns A, B, C, E and L. One of these could be light deflection due to gravitation.

The orbital angular velocity of the object m around M is easy to measure and can be calculated by first calculating:

$$v = \frac{dr}{dt} = \frac{dr}{d\theta}\frac{d\theta}{d\tau}\frac{d\tau}{dt} \quad -(18)$$

to give:

$$\frac{dr}{dt} = \frac{Lc^2 A}{EC^{1/2}(r)}\frac{dr}{d\theta}. \quad -(19)$$

So the orbital angular velocity is:

$$\omega = \frac{d\theta}{dt} = \frac{d\theta}{dr}\frac{dr}{dt} = \frac{Lc^2 A}{EC^{1/2}(r)} \quad -(20)$$

giving a second independent experiment. It is possible to measure experimentally in astronomy the dependence of θ on r, giving a third experiment. The fourth experiment consists of measuring the dependence of r on t, and the fifth experiment the measurement of the total orbital velocity v in Eq. (9). The measurement of the precession of the perihelion is not an unequivocal experiment in the solar system because the precession is very tiny and prone to uncertainties as is well known. It has become clear in recent work that Einstein did not predict this precession correctly, neither did he predict the deflection of light due to gravitation or the gravitational time delay.

Line element general relativity is no longer a predictive method of physics, and experiments to "verify" Einstein's incorrect theory are meaningless. It might be more straightforward to develop a cosmology based on the field equations of ECE theory, using the spin connection rather than the metric and this will be the subject of future work.

3. NUMERICAL ANALYSIS

Section by Dr. Horst Eckardt

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3 Numerical analysis

As an example for the parameters of the Crothers metric we consider a precessing elliptical orbit. This is given by

$$r = \frac{\alpha}{\epsilon \cos (x\, \theta) + 1} \tag{21}$$

and the derivative of the orbit is

$$\frac{dr}{d\theta} = \frac{r x}{\alpha} \sqrt{\epsilon^2\, r^2 - (\alpha - r)^2}. \tag{22}$$

Equating the square of this exapression with Eq.(16), the general expression for the squared orbital derivative, gives

$$\frac{r^2 x^2}{\alpha^2} \left(\epsilon^2\, r^2 - (\alpha - r)^2\right) = \frac{m\, \mathrm{D}\,(r)^2}{B\, L^2} \left(\frac{E^2}{c^2\, m\, A} - \mathrm{D}\,(r) \left(\frac{L^2}{m\, \mathrm{D}\,(r)^2} + c^2\, m\right)\right) \tag{23}$$

where we have defined

$$D(r) := \sqrt{C(r)}. \tag{24}$$

Solving this equation for $D(r)$ gives an equation of third order. The three solutions are complex-valued and highly complicated but can be handled by computer algebra. The real parts of the solutions are graphed in Fig. 1. They are in part negative so that the function $C(r)$ is imaginary in those regions. We plotted the real values of $C(r)$ in Fig. 2. It can be seen that only the third solution is regular for the whole r range so that it can be assumed that this is the physically relevant solution.

The angular frequency given by Eq. (20) is propartional to the inverse square root of $C(r)$. This is graphed in Fig. 3. From this plot it is quite obvious that only the third solution is physical.

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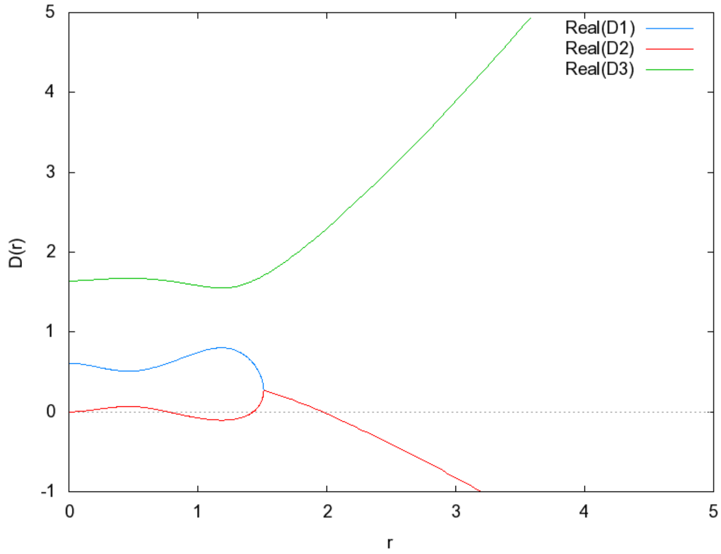

Figure 1: Real part of the solutions D(r) for parameters $\alpha = x = A = B = m = c = L = 1, \epsilon = 0.3, E = 1.5$.

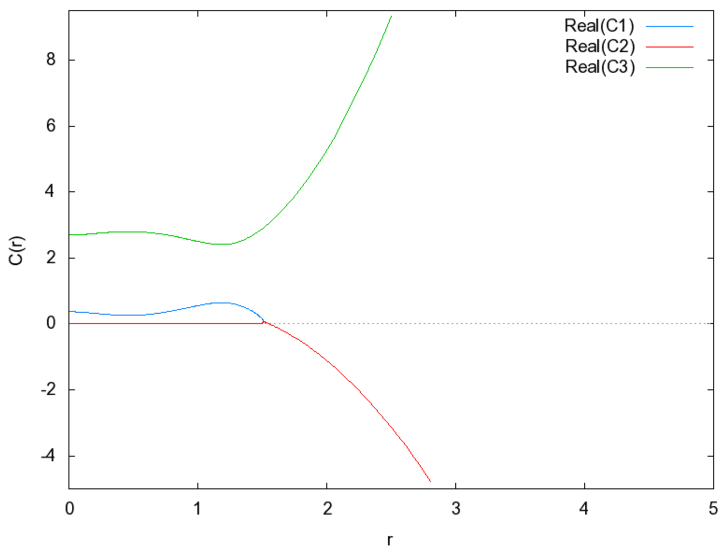

Figure 2: Solutions C(r).

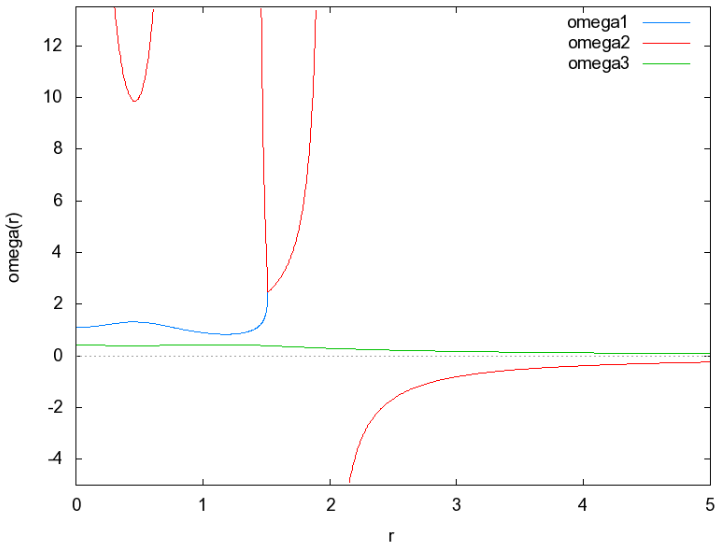

Figure 3: Angular velocities corresponding to C(r).

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