

# A general metric for cosmology.

by

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## Abstract

A general metric is suggested for use in cosmology using the idea of spherically symmetric spacetime instead of the incorrect Einstein field equation. The lagrangian, equation of motion and orbital equation are derived from the metric, which is used to calculate the deflection of light due to gravitation. The metric reduces to well known results in given limits.

*Keywords:* ECE Orbital Theorem, spherically symmetric spacetime, general metric for cosmology, lagrangian, equation of motion, orbital equation, deflection of light due to gravitation.

## 1. Introduction

During the course of development of Einstein Cartan Evans (ECE) field theory it has been found that the Einstein field equation is erroneous [1 – 10] due to the use of an incorrect connection symmetry, and that his calculation of light deflection by gravitation is erroneous by six orders of magnitude [11]. This ends any remaining confidence in the standard model of cosmology. In order to replace these obsolete ideas it was suggested in UFT 111 of this series [1 -10] that solutions of the Orbital Theorem be used to construct new general metrics based on the idea [12] of spherically symmetric spacetime. In Section 2 such a metric is proposed and used to develop the lagrangian, equation of motion and orbital equation for a general type of spherically symmetric spacetime. This is done entirely without reference to the Einstein field equation, and without using the connection. The metric is reduced to standard model results in limits, but with the caveat that the standard model methods of cosmology are fundamentally erroneous. In Section 3 the light deflection due to gravitation is calculated with the new metric.

## 2. Development of the spherically symmetric metric.

The metric for a spherically symmetric spacetime in cylindrical polar coordinates is:

$$ds^2 = c^2 d\tau^2 = e^{2\alpha} c^2 dt^2 - e^{2\beta} dr^2 - r^2 d\varphi^2 \quad (1)$$

in the XY plane. This is a solution of the Orbital Theorem of UFT 111. Other, yet more general, metrics may be used for a spherically symmetric spacetime. In general,  $e^{2\alpha}$  and  $e^{2\beta}$  are functions of both  $r$  and  $t$ , but for simplicity it is assumed [12] that they are functions of  $r$  only. The lagrangian is then [2]:

$$\mathcal{L} = T = \frac{1}{2} mc^2 = \frac{m}{2} \left( e^{2\alpha} c^2 \left( \frac{dt}{d\tau} \right)^2 - e^{2\beta} \left( \frac{dr}{d\tau} \right)^2 - r^2 \left( \frac{d\varphi}{d\tau} \right)^2 \right) \quad (2)$$

and the constants of motion are total energy:

$$E = e^{2\alpha} mc^2 \frac{dt}{d\tau} \quad (3)$$

the angular momentum:

$$L = mr^2 \frac{d\varphi}{d\tau} \quad (4)$$

and the linear momentum:

$$p = e^{2\beta} m \frac{dr}{d\tau} \quad (5)$$

The Orbital Theorem implies that:

$$e^{2\alpha} = e^{-2\beta} \quad (6)$$

Thus:

$$m \left( \frac{dr}{d\tau} \right)^2 = \frac{E^2}{mc^2} - e^{-2\beta} \left( mc^2 + \frac{L^2}{mr^2} \right) \quad (7)$$

where:

$$\frac{dr}{d\tau} = \frac{d\varphi}{d\tau} \frac{dr}{d\varphi} = \left( \frac{L^2}{mr^2} \right) \frac{dr}{d\varphi} \quad (8)$$

so:

$$\left( \frac{dr}{d\varphi} \right)^2 = r^4 \left( \frac{1}{b^2} - e^{-2\beta} \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right) \quad (9)$$

where

$$a = \frac{L}{mc} \quad , \quad b = \frac{cL}{E} \quad . \quad (10)$$

The orbital equation of spherically symmetric spacetime is therefore:

$$\frac{d\varphi}{dr} = \frac{1}{r^2} \left( \frac{1}{b^2} - e^{-2\beta} \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right)^{-\frac{1}{2}} \quad (11)$$

Reduction to other types of spacetime occurs as follows. The Minkowski spacetime is defined by:

$$e^{2\alpha} = e^{-2\beta} = 1 \quad (12)$$

and the orbital equation for the Minkowski spacetime is:

$$\frac{d\varphi}{dr} = \frac{1}{r^2} \left( \frac{1}{b^2} - \frac{1}{a^2} - \frac{1}{r^2} \right)^{-\frac{1}{2}} \quad (13)$$

The Minkowski metric is

$$dr \cdot dr = c^2 (dt^2 - d\tau^2) = v^2 dt^2 \quad (14)$$

where by definition, the total linear velocity is defined by:

$$v = \frac{dr}{dt} \quad . \quad (15)$$

Thus:

$$v^2 dt^2 = dr^2 + r^2 d\varphi^2 \quad (16)$$

The constants of motion of the Minkowski metric are:

$$E = mc^2 \frac{dt}{d\tau} = \gamma mc^2 \quad (17)$$

$$L = mr^2 \frac{d\varphi}{dt} = \gamma mr^2 \omega \quad (18)$$

where

$$\omega = \frac{d\varphi}{dt} \quad (19)$$

Therefore the constants  $a$  and  $b$  are related by:

$$a = \gamma b = \gamma r^2 \frac{\omega}{c} \quad (20)$$

It follows that:

$$\frac{1}{b^2} - \frac{1}{a^2} = \frac{1}{b^2} \left( 1 - \frac{1}{\gamma^2} \right) = \left( \frac{v}{c} \right)^2 \frac{1}{b^2} = \left( \frac{v}{r^2 \omega} \right)^2 \quad (21)$$

is a constant of motion and that:

$$\varphi \text{ (Minkowski)} = \int \frac{1}{r} \left( \left( \frac{v}{\omega r} \right)^2 - 1 \right)^{-1/2} dr \quad (22)$$

Therefore the Minkowski metric is sufficient to give an orbit. The deflection of light due to gravitation in the Minkowski metric is:

$$\Delta \varphi = 2 \int_{R_0}^{\infty} \frac{1}{r} \left( \left( \frac{v}{\omega r} \right)^2 - 1 \right)^{-1/2} dr \quad (23)$$

where  $v$  is the velocity of the photon with mass. If the velocity of the photon is considered to be close to  $c$  then, to a good approximation:

$$\Delta \varphi \sim 2 \int_{R_0}^{\infty} \frac{1}{r} \left( \left( \frac{c}{\omega r} \right)^2 - 1 \right)^{-1/2} dr \quad (24)$$

and the orbital angular velocity  $\omega$  of the photon can be found from the experimentally measured  $\Delta\varphi$ . In a circular orbit (Einstein's incorrect [2] assumption):

$$v = \omega r \quad (25)$$

and the denominator in Eq. (23) becomes zero, so the integral becomes singular.

The gravitational metric is defined by another possible solution of the Orbital Equation and is:

$$e^{2\alpha} = e^{-2\beta} = 1 - \frac{r_0}{r} \quad (26)$$

where:

$$r_0 = \frac{2MG}{c^2} . \quad (27)$$

Here  $G$  is Newton's constant, and  $M$  is the mass of the attracting object. In the obsolete physics known as the standard model, the gravitational metric is incorrectly attributed to K. Schwarzschild [5]. It is true that the latter gave solutions of the incorrect Einstein field equation in 1916, but these solutions are not the metric (26). All solutions of the Einstein field equation are meaningless because of the neglect of torsion. The orbital equation from metric (26) is:

$$\frac{d\varphi}{dr} = \frac{1}{r^2} \left( \frac{1}{b^2} - \left( 1 - \frac{r_0}{r} \right) \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right)^{-1/2} \quad (28)$$

and this equation was used in ref. [11] to give the correct calculation of light deflection due to gravitation for the first time. The correct calculation gives the photon mass from light deflection for the first time.

The metric of the binary pulsar [2] is given from the Orbital Theorem as:

$$e^{2\alpha} = e^{-2\beta} = 1 - \frac{r_0}{r} - \frac{\xi}{r^2} \quad (29)$$

so the orbital equation of the binary pulsar is:

$$\frac{d\varphi}{dr} = \frac{1}{r^2} \left( \frac{1}{b^2} - \left( 1 - \frac{r_0}{r} - \frac{\xi}{r^2} \right) \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right)^{-1/2} \quad (30)$$

which is a precessing ellipse gradually spiralling inwards. In the standard model this is explained by gravitational radiation, but this explanation is no longer tenable because of the use of the wrong connection symmetry in the Einstein field equation. As in ref. [2], metric (29) is able to explain the details of the binary pulsar without using the Einstein field equation or gravitational radiation.

In a whirlpool galaxy the stars are arranged in a logarithmic spiral:

$$r = r_0 e^{\xi\varphi} \quad (31)$$

so

$$\frac{dr}{d\varphi} = \xi r \quad (32)$$

and so:

$$\xi = r \left( \frac{1}{b^2} - e^{-2\beta} \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right)^{1/2} \quad (33)$$

with:

$$e^{2\alpha} = e^{-2\beta} = \left( \frac{1}{b^2} - \frac{\xi^2}{r^2} \right) \left( \frac{1}{a^2} + \frac{1}{r^2} \right)^{-1} \quad (34)$$

In all cases the metric is:

$$ds^2 = e^{2\alpha} c^2 dt^2 - e^{-2\alpha} dr^2 - r^2 d\varphi^2 \quad (35)$$

so this is a generally valid metric that reduces to special cases. For the general spherically symmetric spacetime the orbital equation is:

$$\frac{d\varphi}{dr} = \frac{1}{r^2} \left( \frac{1}{b^2} - e^{2\alpha} \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right)^{-1/2} \quad (36)$$

so this metric may be used to calculate the deflection of light due to gravitation. Some comments on this are given in the next section.

### 3. Deflection of light due to gravitation in spherically symmetric spacetime.

The equation for light deflection by the metric of spherically symmetric spacetime is:

$$\Delta \varphi = \int_{R_0}^{\infty} \frac{1}{r^2} \left( \frac{1}{b^2} - e^{2\alpha} \left( \frac{1}{a^2} + \frac{1}{r^2} \right) \right)^{-1/2} dr \quad (37)$$

where  $R_0$  is the distance of closest approach. As described in UFT 150 of this series the parameters  $a$  and  $b$  may be estimated from the experimental value of light deflection when:

$$a = \frac{E}{mc^2} \quad b = \left( \frac{\hbar\omega}{mc^2} \right) \quad b = \left( \frac{\hbar\omega}{mc^2} \right) R_0 \quad (38)$$

The method in UFT 150 gave a value of  $5 \times 10^{-41}$  kg for the photon mass. Eq. (32) is a particular case of a more general solution, and so the value of photon mass would depend on

the type of spacetime being considered. It is clear that the Einstein field equation has failed in at least two respects, the connection used is symmetric, whereas it should be antisymmetric, and UFT 150 shows that the method used to calculate light deflection is wildly erroneous due to the assumption of zero photon mass. The Orbital Theorem of UFT 111 on the other hand assumes only that spacetime is symmetric, and this paper shows that the simple assumption of spherical isotropy provides a plausible general metric for cosmology, i.e. for solar system orbits, the relativistic Kepler problem, whirlpool galaxies and binary pulsars, to take a few examples at random. The Einstein field equation fails completely to describe objects such as whirlpool galaxies, and to explain binary pulsars, the standard cosmology is forced to use the assumption of gravitational radiation, an assumption based again on the incorrect Einstein field equation.

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