Deutsche Physikalische Gesellschaft
Frühjahrstagung Gravitation und Relativitätstheorie
Berlin, 15. - 20. März 2015

Cosmology and Lorentz-Interpretation (LI) of GRT

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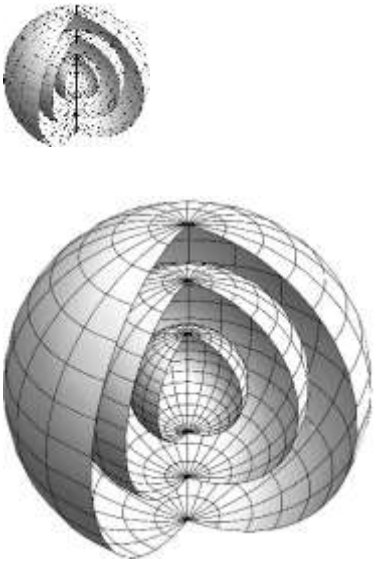
Preliminary version
10/21/2014 last update: 10/21/2014

Abstract
1.) SM (Schwarzschild metric) of central symmetric stars, RWM (Robertson-Walker-metric) of exploding dust stars and RWM of expanding universe are closely connected. So it is no surprise that the proven contradiction of energy formulas (2) and (3) of SM of classical GRT [2,3] has a similar consequence for RWM. In this case, the total energy of a sphere is predicted different from what would be measured. See formulas (1) and (3).

2.) The *physical reason* for this contradiction is similar to the one of SM [2,3]: The measurement of total energy in a free falling reference system (on a shell) does not realize the change of rest mass in a gravitational field. Considering the changing rest mass solves this contradiction. Above this, it allows some explanation of: (1) Why is there an inflationary phase at the beginning of big bang and (2) where could the energy needed for today's acceleration phase of our universe come from?

1. Introduction

Exploding or imploding dust stars and expanding universe are described by the same metric, the Robertson-Walker-metric, RWM, and by the same formulas for the scale factor *a(t),* named Friedmann equations. This accordance is well known [4,5,6]. Above, there is a close connection with SM since e. g. the expanding dust star consists of expanding shells which feel gravitational forces only by the inner shells. This follows from Birkhoff's theorem [1]. Also a consequence from Birkhoff's theorem is that the gravitational forces of the inner shells are the same as those of a static central symmetric star with the same mass as all the inner shells possess together. Let's call it m_{inner} . So one can say that every shell of a dust star is free falling in the gravitational field of some SM – the SM of a central symmetric object with mass equal to m_{inner} . Therefore it has to be demanded that within RWM there is a similar contradiction of total energy as with SM and it is not surprising that this can be proven.
Fig. 1 illustrates the shell structure of an expanding dust star.



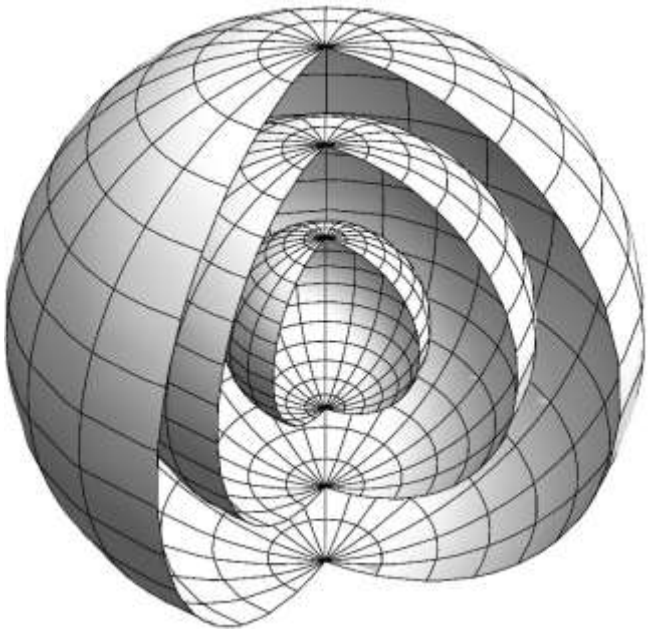


Fig. 1. Three time points of an expanding dust star

The shells of an expanding dust star are hollow spheres. Only the inner shells exert gravitational forces on the outer ones.

(Taken from Brandes, Czerniawski [1], fig. 22.1.)

2. Contradictious total energy in RWM

The total energy of dust stars with $k = +1,\ 0,\ -1$ is predicted by the same formula for all k and is equal to its gravitational mass m_{grav} times c^2 :

$$m_{grav} = \frac{4}{3}\pi\mu\rho_0{}^3 R(c\tau)^3 = \frac{4}{3}\pi\mu r_0{}^3 \tag{1}$$

See STEPHANI [357], equation (23,45) and all the other textbooks, too. This equation is correct since it is derived from Hilbert-Einstein-field equations. It corresponds to formula (2) of [2,3].

But this is different from what would be measured. Classical GRT (or Einstein interpretation, EI) predicts m_{EI} which corresponds to formula (3) of [2,3]:

$$m_{EI} = \int_{\text{all shells}} dm_{measured} = \int_{\text{all shells}} \mu_{measured}(c\tau)\, dV_{measured} \tag{2}$$

Inserting $\mu_{measured} = \frac{dm_{measured}}{dV_{measured}}$ into (2) and using that $\mu = \mu(c\tau)$ is a function of proper time τ only one gets:

$$m_{EI} = \mu_{measured}(c\tau) \int_{\rho=0}^{\rho=\rho_0} dV_{measured}$$

$$m_{EI} = \mu_{measured}(c\tau) \int_{\rho=0}^{\rho=\rho_0} 4\pi\rho^2 R(c\tau)^2 \frac{R(c\tau)\,d\rho}{\left(1-k\rho^2\right)^{\frac{1}{2}}}$$

$$m_{EI} = 4\pi\mu_{measured}(c\tau)R(c\tau)^3 \int_{\rho=0}^{\rho=\rho_0} \frac{\rho^2 d\rho}{\left(1-k\rho^2\right)^{\frac{1}{2}}} \tag{3}$$

This integral agrees with m_{grav} for $k=0$ only.

For LI of GRT the arguments become different and correspond to formula (2) of [2,3]:

$$\begin{aligned} m_{LI} &= \int_{\text{all shells}} dm_{LI} \\ &= \int_{\text{all shells}} dN\, m_0\left(1-k\rho^2\right)^{\frac{1}{2}} \quad \text{for all } k \end{aligned} \tag{4}$$

dN : particle number of a shell

$m_0\left(1-k\rho^2\right)^{\frac{1}{2}}$: correct mass of a particle, s. (20.6) of Brandes, Czerniawski [1].

Insertion of (5) into (4) leads to (6). The integration in (6) is allowed since $\mu = \mu(c\tau)$ is a function of proper time τ only.

$$\begin{aligned} \mu_{measured} &= \frac{dm_{measured}}{dV_{measured}} \\ &= \frac{dNm_0}{4\pi\rho^2 R(c\tau)^2 \frac{R(c\tau)d\rho}{\left(1-k\rho^2\right)^{\frac{1}{2}}}} \end{aligned} \tag{5}$$

$$\begin{aligned} m_{LI} &= \int_{\text{all shells}} \mu_{measured}\, 4\pi\rho^2 R(c\tau)^2 R(c\tau)d\rho \\ &= \frac{4}{3}\pi\mu_{measured}\ \rho_0{}^3 R(c\tau)^3 \\ &= m_{grav} \end{aligned} \tag{6}$$

This integral agrees with m_{grav} for all values of k .

The evaluation of m_{grav}, m_{EI} and m_{LI} has proven the contradiction within classical GRT and its solution by LI of GRT. More details s. [1] p. 327ff but let us repeat: Formula (1) corresponds to formula (2) of [2,3] of SM and gives the correct total energy of a dust star. Formula (3) corresponds to formula (3) of [2,3] of SM and gives what is *measured* by all of the observers resting on the free falling shells, s. fig.1. Steps (2) to (6) show how the correct formula (1) is derived from formula (3) using the argument of LI of GRT that rest masses reduce in gravitational fields.

3. The reason of inflation at big bang and the origin of energy of today's acceleration phase of universe

Let us *assume* that LI of GRT is true then this gives a qualitative explanation of 1.) the reason of inflation and 2.) the energy source of today's accelerated expansion of universe. These considerations are similar to those of explaining fireballs of GRB's [7].

Solving the contradiction of the energy formulas (2) and (3) in [2,3] has lead to following results:

(a) Free falling particles in SM decrease their rest mass, s. formula (2) in [2,3].

(2) of [2, 3]

$$E_G = mc^2\left(1-\frac{2GM}{c^2 r}\right)^{1/2}$$

This was qualitatively explained by Higgsfields - they *give* elementary particles a rest mass - and by gravitational fields – they *take* rest mass *away*.

(b) Gravitational fields only exist if there are particles with rest mass $\neq 0$.

Contrary, within classical GRT:

(a) the rest mass of a free falling particle remains constant,

(b) gravitational fields depend on total energy independent of a rest mass

(a) and (b) of LI of GRT remains true for RWM, especially for the particles of the shells (s. fig. 1) describing imploding or exploding dust stars or an expanding universe (if universe is considered as a metagalaxy). Concerning the gravitational field of RWM it means: At big bang Higgsfields *give* elementary particles a rest mass and this leads to attractional gravitational fields which try to invert this process and which try to reduce the rest mass. At first there are massless particles (waves), then Higgsfields give them rest mass and by this gravitational fields arise. This allows two remarks:

1.) The inflation during the GUT era was invented to eliminate difficulties of the standard big bang theory, e. g. the flatness problem.

Assume a fireball starting from a singularity at big bang. This is the same situation as with the start of fireballs of GRB's. All particles without rest mass behave like waves and expand with the velocity of light. So one gets an inflationary expansion since no gravitational fields exist. Gravitational fields arise as soon as particles get a rest mass. Now a soft exit from inflation and a soft entrance to some Friedman universe is started.

2.) The accelerated expansion of the universe is a widely accepted fact proved by redshift measurements of type Ia supernova [8]. To explain this observation Einstein's cosmological constant is reinvented. Acceleration of all of the galaxies of the universe needs huge energy but where does it come from? LI of GRT can give a suggestion: Since Higgsfields *give* elementary particles a rest mass changing Higgsfields could reduce the rest mass of elementary particles and since the total energy remains constant the particles become accelerated. The same is true for galaxies built-up of these particles.

These two remarks concerning cosmology show that LI of GRT has own suggestions but is not in contradiction with mainstream physics.

4. Literature

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