# LIMITATIONS OF POSSIBILITY TO DETECT GRAVITATIONAL WAVES CAUSED BY GRAVITATIONAL BARRIER

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**ABSTRACT:** *Modern detectors intended to detect gravitational waves are in function from 2002. Their figure of merith has reached $h = 10^{-21}$ from 2007 approaching current values $h = 10^{-23}$. Given the number of existing detectors, several hundreds of events involving gravitational waves should be registered to the present day. In reality, there is no one such an event, in spite of the fact that the existence of gravitationa waves has been evidenced indirectly through the binary pulsar PSR 1913+16.*
*One of the modes of explanation the given state lies in a presumption that due to a non-stationary gravitational field, gravitational radiation is formed creating a barrier for gravitational waves detection. Based on our Expansive Nondecelerative Universe model we declare that only extremely strong sources exceeding the limiting value $h = 10^{-16}$ may be detected.*

## 1:INTRODUCTION

The existence of gravitational waves results from general theory of relativity, which is a cornerstone the current theory of gravity. Gravitational waves produce a periodic curving of spacetime, propagating from the source analogically as sound or electromagnetic waves. In case of gravitational waves the mass distribution cannot be symmetrical in regard to point or axis. Gravitational waves transfer, similarly as other kind of waves, energy and their intensity decrease with the square of distance from their source.
Up-to-now there are only indirect proves of gravitational waves based on observation of the binary-pulsar PSR 1913+16. Modern detectors, such as LIGO,LISA,VIRGO,TAMA and GEO 600 [1] are approaching a sensitivity value $10^{-23}$. At the sensitivity $10^{-21}$ we should be able to detect the gravitational waves created by supernovae, e.g. in cluster of galaxies
in constellation of Virgo, distant about 40 millions of light-years from us. In this space there is more than 2000 galaxies with several supernovae burst up yearly. It means that gravitational waves should be identified. However, it is not the case. The community of physics becomes a bit nervous and alternative theories have been formulated denying the existence of gravitational waves.

## 2: EXISTENCE OF GRAVITATIONAL BARRIER

One of the fundamental postulate of our Expansive Nondecelerative Universe (ENU) model declares that our Universe has been expanding by a constant velocity being equal to the velocity of light $c$ [2-7]. The Universe matter and gravitational energy are gradually increasing. The Universe gravitational energy is negative and the total Universe energy is thus equal to zero and the conservation laws are obeyed. Gravitational field is nonstationary.
Introducing the transformations $m \rightarrow m_t$ leads to:

$$\frac{dm_t}{cdt} = \frac{m_t}{a} \qquad \textbf{(1)}$$

where $a \cong 1.3 \times 10^{26}$ m ($a$ is the gauge factor of the Universe)

In regard to eq. (1) when using Schwarzschild metric the components of momentum-energy tensor
are obtained from Einstein field equations:

$$T_0^0 = T_1^1 = 0 \qquad (2)$$

$$T_2^2 = T_3^3 = \frac{c^4 r_{(g)}^2 r}{8\pi G a^2 (r - r_{(g)})^3} \qquad (3)$$

$$T_0^1 = -\frac{c^4 r_{(g)}}{8\pi G a r^2} \qquad (4)$$

The component $T_0^1$ expresses the energy density of localized gravitational field. In the vicinity of black hole, if $r > r_g$, it holds

$$T_2^2 = T_3^3 = \frac{c^4 r_{(g)}^2}{8\pi G a^2 r^2} \qquad (5)$$

These last components represent gravitational radiation due to a non-stationary gravitational field in spite of the spherical symmetry of the field. This radiation is not of quadrupole nature and is created due to matter creation (it is an additional curvature of the spacetime). It manifests itself in the form of ever-present noise or background fluctuation and forms a barrier for gravitational waves with lower amplitude.
For the critical energy density it holds:

$$\varepsilon_{crit} = \frac{3c^4}{8\pi G a^2} \qquad (6)$$

Dividing (5) and (6), an amplitude $l$ is obtained as:

$$l = \frac{r_{(g)}^2}{3r^2} \qquad (7)$$

This amplitude represents a barrier for gravitational waves detection. Only the waves with a higher amplitude can be identified. At the Earth conditions, the most important is the gravitational field of the Sun. The equation (7) leads to the value $l = 10^{-16}$ . This is why only

the gravitational waves with $h \geq 10^{-16}$ can be detected in our conditions. (By the way, for the impact of a black hole in the centre of our galaxy, $l = 7x10^{-22}$, for Cygnus $l = 4\times10^{-31}$ and for gravitational impact of our Earth at its surface $l = 10^{-18}$.)

## 3: CONCLUSIONS

Given the full validity of Theory of General Relativity we offer a hypothesis that there is a barrier which does not allow the detection gravitational waves with low amplitude. It means that to detect gravitational waves, a supernova located 100 ligth-years from the Earth should explode. It is worth pointing out that this is only a working hypothesis. It will be necessary to construct still more and more sensitive detectors trying to detect gravitational waves. Our hypothesis will become more justifiable if no gravitational waves are detected even using more sensitive detectors.

One of the possibilities to prove gravitational barrier lies in a detail analysis of noise detected by Geo 600 detector [8].

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