Frontiers of Science and Theory1 No. 1 P. 48-59
Intrepid Publishing LLC

A very simple explanation for the phenomena usually related to dark matter and dark energy

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Received 4/6/18

Abstract:
In this article a very simple explanation is given for the phenomena usually referred to dark matter and dark energy. The phenomena like high galaxy rotational velocity and accelerating expansion of the universe, which is usually related to the existence of dark matter and dark energy, is supposed to be due to the wave nature of gravitation wave: gravitation waves are waves and therefore submitted to wave phenomena like diffraction, superposition and interference: by superposition, the gravitation waves are superimposed one another yielding interference maxima and minima. The matter is concentrated in the interference maxima explaining the material distribution inside the universe. Thus the existence of dark matter and dark energy is not required any longer.
Also the Doppler effect is applied to gravitational waves yielding the Einstein equations of the Special Relativistic Theory.

Introduction:
Inside the universe, so-called voids and filament exist resembling a hugh interference pattern: the great amount of matter are concentrated in the filaments which are tubelike conglomerates of material (galaxy cluster etc.). Between the filaments so-called voids, extremely wide areas, exist almost without any matter [1].
Galaxies are rotating much faster than predicted without being torn away contributed to the existence of dark matter [2].
The accelerating universe expansion is contributed to the existence of dark energy [3] - [4].
Various explanations are given for the existence of dark matter or dark energy, e.g. WIMP, MACHO, Axions, Majorana Fermion, Goldstino or Supersymmetry [5] – [7].
As an alternative to the dark matter and the dark energy, the Modified Newtonian Dynamics Theory is vastly discussed in the last decades [8] – [10].

Theory:

The Einstein field equations $G_{\mu\nu} = \kappa T_{\mu\nu}$ told us the relation between Einstein tensor $G_{\mu\nu}$ and the stress-energy tensor.

Gravitational wave wavelength and amplitude

A gravitational wave can be considered as a spherical wave: Its origin is a mass point from which it is propagating in all spatial directions in a homogeneous way. The spherical surface A_{sphere} can be calculated by $A_{sphere} = 4\pi r^2$ with r as the distance between the mass point and the spherical surface. The intensity I of the gravitational wave is the ratio between wave energy E and spherical surface area A_{sphere} : $I = E/A_{sphere}$. Now the intensity I of the gravitational wave is proportional to the square of its field amplitude F: $I \propto F^2$, while $I \propto 1/A_{sphere} \propto 1/r^2$. So the field amplitude F of gravitational wave is linearly proportional to 1/r. This means that the field amplitude F is inversely proportional to the distance to the mass point from which the gravitational wave is originally emitted. Thus the gravitational wave field amplitude in dependence from the distance r is enveloped by a 1/r-function (Fig. 1 a,b). Also Einstein has predicted that an accelerated mass m emits gravitational waves by a frequency f. Approximately, one assumes that the frequency f is linearly proportional to the acceleration a of the mass m: $f \propto a$. Consequently, a non-accelerated mass (e.g. a resting mass) emits gravitational waves with the frequency = 0, while an accelerated mass emits gravitational waves with a frequency > 0.

Also, it is assumed that the gravitational wave field amplitude F is linearly proportional to mass m: $F \propto m$.

Now we can consider the following three cases:

In case of a highly-accelerated mass point m, the mass point has a high acceleration a_1 and the gravitational wave frequency f_1 is also high due to $f \propto a$. So the wavelength $\lambda_1 = c/f_1$ is small as shown in Fig. 1a. The field amplitude is enveloped by a 1/r-function as explained above. Now the mass point m is decelerated, so the acceleration a_2 of the mass point is medium or even low: $a_2 < a_1$. Thus the gravitational frequency f_2 becomes also small: $f_2 < f_1$ and the wavelength λ increases: $\lambda_2 > \lambda_1$ (Fig. 1b). As shown in Fig. 1b, the field amplitude of the gravitational wave starts to adapt to the 1/r-envelope function due to its increasing wavelength, or in other words the 1/r-envelope function starts to approximate the field amplitude of the gravitational wave depending on the propagating distance r.

Now the mass point m continues to decelerate until the acceleration becomes 0. Thus its acceleration a_3 is 0 and $a_3 = 0 < a_2 < a_1$, also f_3 is 0 and $f_3 = 0 < f_2 < f_1$. Consequently, the wavelength λ_3 goes to infinity with λ_3 infinite and $\lambda_3 = \infty > \lambda_2 > \lambda_1$. So the gravitational field amplitude totally adapts to the 1/r-envelop function or the 1/r-envelop function completely approximates the gravitational wave field amplitude depending on propagating distance r: in this case one can claim that both the field amplitude of the gravitational wave depending on r and the 1/r-envelope function are identical. Now the 1/r-envelope function can be considered as the gravitational potential, so the gravitational potential is nothing else a gravitational wave emitted by a resting mass point without any acceleration ($a = 0$).

According to Fig. 1a,b the gravitational wave has positive as well as negative oscillation field amplitudes as all kinds of wave do. The positive oscillation field amplitude has a positive value while the negative oscillation field amplitude has a negative value. In the area of negative oscillation field amplitude, the space is deformed by compression, thus the gravitation in this area is attractive. In the area of positive oscillation field amplitude, the space is deformed by extension, thus the gravitation in this area is repulsive, that means two mass points, which are spatially separated by this distance so one mass point is in the area of positive oscillation field amplitude, repel one another. Gravitational repulsion can also explain the phenomenon of dark energy responsible for the accelerating expansion of the universe. Summarizing, the gravitational wave has an attractive component in the area of negative oscillation field amplitude and a repulsive component in the area of positive oscillation field amplitude.

Gravitational wave quantum energy

Even modern Experimental Physics fails to determine the quantum energy of gravitational wave, most likely the quantum energy is so small that it cannot be measured even by nowadays sophisticated experimental equipment [11]. So we can estimate the quantum energy of gravitational wave being around less than 10^{-50} J. With $E = h\nu = hc/\lambda$, this yields a wavelength of gravitational waves of around 10^{8} light years. This means it takes 100 million years until a complete gravitational wave passes the earth.

Interference of gravitational waves

Gravitational waves are waves and thus subject to wave phenomenon like diffraction, superposition and interference. Diffraction only takes place if a wave front arrives at an object whose dimension is of the order of the wavelength of the incoming wave. In case of

gravitational waves featured by a wavelength of 100 million light years or even more, it takes a galaxy for diffracting such an incoming gravitational wave. By diffraction, two gravitational waves are superimposed one another. So interference occurs resulting in an interference pattern featured by interference maxima and interference minima. The interference maxima and minima are of the magnitude of the wavelength, that means at least around 100 million light years. Inside the interference maxima the gravitational interaction is increased, thus matter is accumulating inside it. Inside the interference minima the gravitational interaction is decreased of even erased, thus in the long run matter is disappearing from its inside. Consequently, this model explains the matter distribution inside the universe characterized by filaments and voids: filaments correspond to the interference maxima in which material is accumulated while voids correspond to the interference minima where almost no material exists.
One can distinguish between two sorts of interference maxima: a positive interference maximum and a negative interference maximum. A positive interference maximum occurs if two positive oscillation field amplitudes superimpose one another in order to form an interference maximum. In this area the gravitation can be repulsive as explained above. This effect can be used to explain the phenomenon of dark energy. A negative interference maximum occurs if two negative oscillation field amplitudes superimpose one another in order to form an interference maximum. In this area the gravitation is attractive as explained above.

Doppler effect applied to gravitational waves:
Gravitational wave is a wave phenomenon and therefore is subject to wave-based effects e.g. like Doppler effect:
If the source is moving and the receiver is resting, the receiver observes the frequency $f_{r,r}$:

$$fr,r = \frac{fs,m}{(1-\frac{v}{c})} \qquad (1)$$

, with $f_{s,m}$ as the frequency emitted by the moving source, v as the relative velocity between the source and receiver and c as the propagating velocity of the waves transmitted by the transmission medium.
If the source is resting and the receiver is moving, the receiver observes the frequency $f_{r,m}$:

$$fr,m = fs,r\,(1+\frac{v}{c}) \qquad (2)$$

, with $f_{s,r}$ as the frequency emitted by the resting source.
In case of the classical Doppler effect, acoustic waves are transmitted by air as a transmission medium. In case of gravitational wave, no transmission medium exists, thus one cannot distinguish between both cases: source is moving and receiver is resting (case 1) or source is resting and receiver is moving (case 2). The same is also valid for electromagnetic waves (light) or any other wave phenomenon without any transmission medium. Consequently, both equations can be put together:

$$\frac{fs,m}{(1-\frac{v}{c})} = fs,r\,(1+\frac{v}{c}) \qquad (3)$$

or

$$fs,r = \frac{fs,m}{(1-\frac{v^2}{c^2})} = \frac{fs,m}{\sqrt{1-\frac{v^2}{c^2}}\sqrt{1-\frac{v^2}{c^2}}} \qquad (4)$$

Even if one might consider the space-time-continuum as a kind of transition medium for gravitational waves, the relativity principle is still valid (that means one cannot distinguish between case 1 and case2), and the above calculation is also still valid.

Taking into consideration f = 1/T und c = λf:

$$fs,r = \frac{fs,m}{(1-\frac{v^2}{c^2})} = \frac{fs,m}{\sqrt{1-\frac{v^2}{c^2}}\sqrt{1-\frac{v^2}{c^2}}} = \frac{c}{\lambda s,m\sqrt{1-\frac{v^2}{c^2}}\sqrt{1-\frac{v^2}{c^2}}} = \frac{1}{Ts,r} \qquad (5)$$

$$\frac{c}{\lambda s,m\sqrt{1-\frac{v^2}{c^2}}} = \frac{\sqrt{1-\frac{v^2}{c^2}}}{Ts,r} \qquad (6)$$

yielding the time dilation:

$$T = \frac{Ts}{\sqrt{1-\frac{v^2}{c^2}}} \qquad (7)$$

and length contraction:

$$\lambda = \lambda s\sqrt{1-\frac{v^2}{c^2}} \qquad (8)$$

In case of gravitational waves, the frequency f does not depend from the velocity, but from the acceleration a: f = f (a), but this have no impact on the above presented calculation.

This result can be interpreted that the time dilation and the length contraction results from the Doppler effect of gravitational waves. Thus the course of time and the length metric on earth depend from the mass distribution around our planet, e.g. from the position, velocity and acceleration from the fixed stars surrounding our planet. If in the long run the fixed stars change their position, velocity and acceleration, this may have an influence of the course of time on our planet, but the period of time required for such a measurable change may be many orders above our life time which is negligibly small against it. So one can remember Paul Dirac demanding who will note if time is running faster or slower.
Also the relativistic mass increase can be explained by the Doppler effect: if a test mass is accelerated and its surrounding is resting, the relativistic principle is valid: so one can consider the test mass as resting and its surrounding as accelerated, thus the accelerated surrounding emits gravitational waves with a frequency larger than zero. Thus the repulsive component of the gravitational waves has an impact on the (actually accelerated) test mass whose mass appears to increase, so an observer realizes it as the relativistic mass increase.

Last but not least, according to this hypothesis, it is not necessary that the velocity of light must be constant; it may be constant, but it could also be variable.

Conclusion:

By this model the material distribution inside the universe and the high rotational velocity of galaxies can be explained (until now contributed to the mysterious dark matter). Also it gives a clue to the accelerating universe expansion (until now contributed to the mysterious dark energy). So the existence of dark matter and dark energy is not necessary any longer.

Figures:

Fig. 1a: the figures show the field amplitude F in dependence on the propagating distance r; the gravitational wave field amplitude F of a mass point m with a high acceleration a_1, showing a short wavelength λ_1, is enveloped by a 1/r-function; the field amplitude F (y-axis) is drawn against the propagating distance r (x-axis)

Fig. 1b: the gravitational wave field amplitude F of a mass point m with a low or medium acceleration $a_2 < a_1$, showing a long wavelength $\lambda_2 > \lambda_1$, adapts to the 1/r-envelope function; the field amplitude F (y-axis) is drawn against the propagating distance r (x-axis)

Fig. 1c: the gravitational wave field amplitude of a mass point m with no acceleration $a_3 = 0 < a_2 < a_1$, showing an infinitely long wavelength $\lambda_3 = \infty > \lambda_2 > \lambda_1$, is identical to the 1/r-envelope function which represents the gravitational potential ; the field amplitude F (y-axis) is drawn against the propagating distance r (x-axis)

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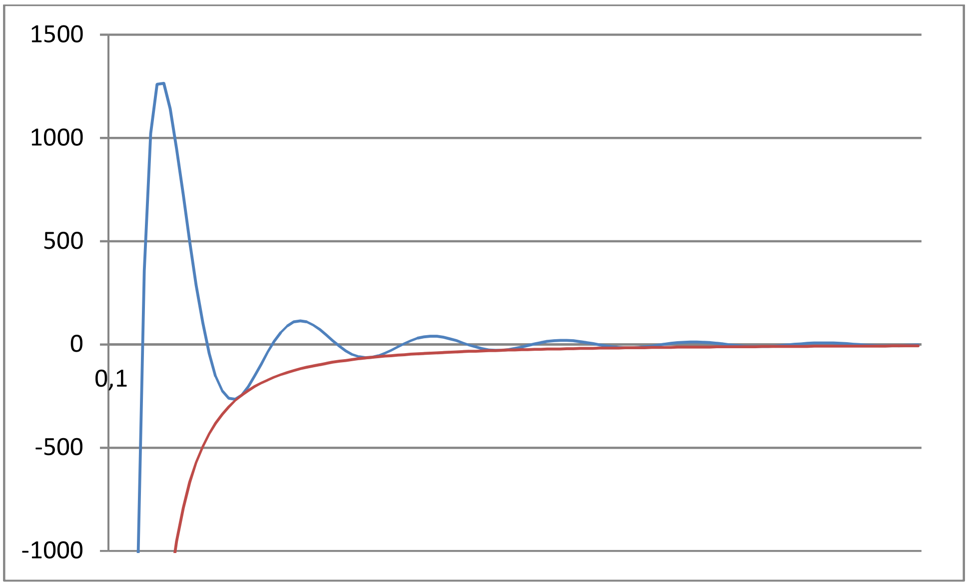

Fig. 1a

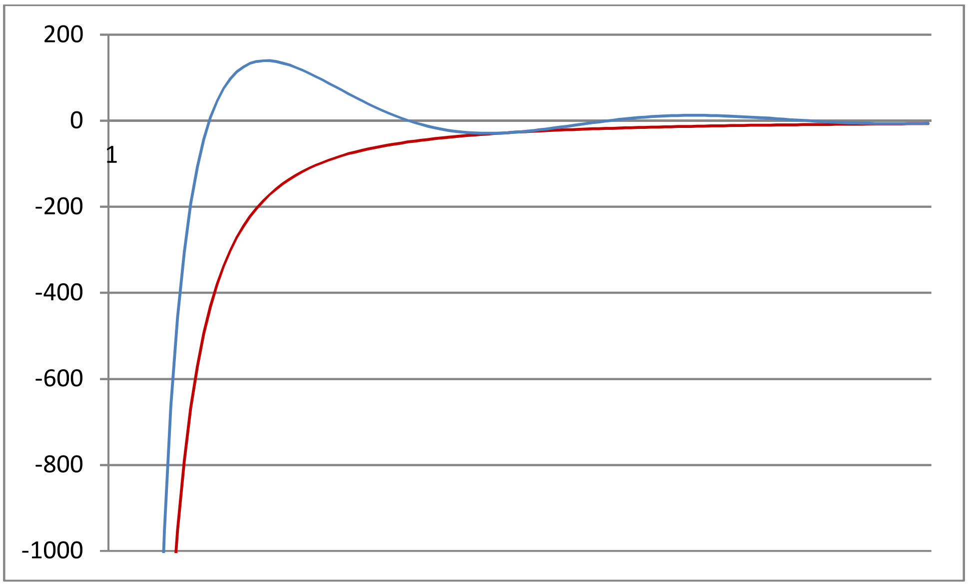

Fig. 1b

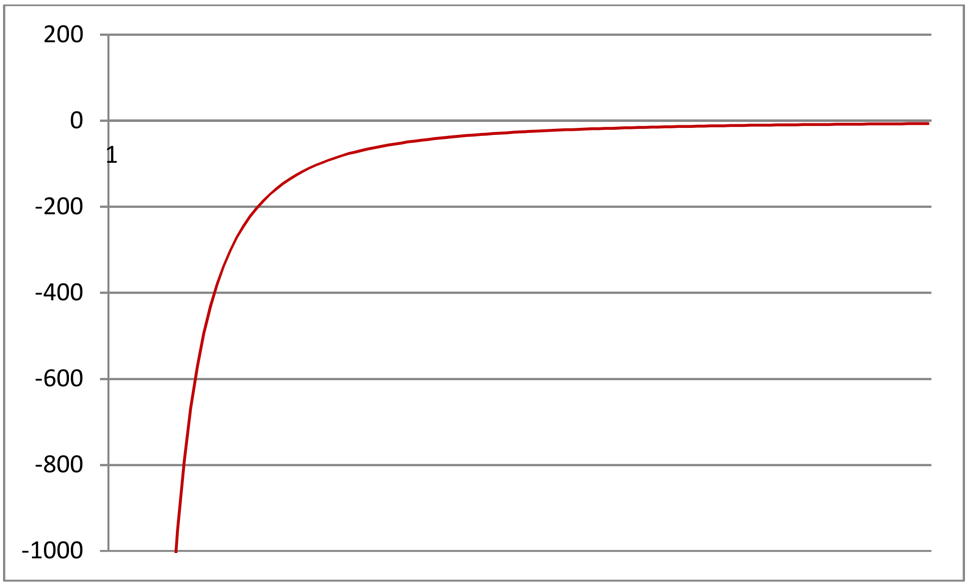

Fig. 1c