Modified Newtonian Dynamics

Introduction.

Before we move on to the MOND, let's recall the known thing that time dilation is. We often hear about this phenomenon, but we rarely mention it in formulas, as in the case of Einstein and Newton

To keep as close as possible to Einstein's formulas, the facts resulting from dilatation are omitted. Let's take an example from two inertial systems.

One is at rest on Earth (hypothetically static) and the other moves at a speed close to the speed of light at which time dilation causes time on the moving object to flow twice as slowly. Up to this point everything is correct. However, further interpretation differs from what we can draw.

If the time for the object flows two times slower than for the static observer, then the speed it will record will be different than the one that the static observer is recording. If, on the other hand, he would like to determine the speed of light, he will give a different value than an observer on Earth. According to his calculations, the light will travel 600,000 km / s because it will observe that the light beam has traveled 600,000 km within its second. This does not mean that the light will fly faster, only the measurement will be different.

If the external observer is subject to time dilation, his calculations will differ from the observer's calculations on Earth. For example, calculating kinetic energy. The observer on Earth will calculate it according to Newton's formulas, which, however, do not take into account the dilation of time and energy needed when the time of the observer moving at the speed of light is "frozen". It will only count energy during the active time of the traveler. It's the same in our world. We are also subjected to dilation of time due to the movement of the Earth and the entire galaxy in the Universe. We do not use formulas that will skip our delay but we count without considering this effect. The same applies to our observer. He will count without considering the dilatation of time. Therefore, the energy it calculates will match the actual kinetic energy it has due to the fact that in its calculations it took into account the time dilation mentioned above.

At the beginning we can calculate what kinetic energy our has traveler.

Substituting Newton's formula, and more precisely for calculating the speed of time dilation, we get:

$$v_r = \frac{v}{\sqrt[2]{1 - \frac{v^2}{c^2}}}$$

It is an enumeration which speed the observer will register, which moves at a speed close to the speed of light and which can be calculated by a static observer taking into account time dilation.

We put the formula on the speed to the formula for Newton's kinetic energy and we get:

$$E_k = \frac{mv^2}{2 * (1 - \frac{v^2}{c^2})}$$

It is a formula by means of which a static observer will calculate the correct value of the kinetic energy of our traveler. The traveler, on the other hand, will use the Newton's formula without taking into account the effect of expansion joints as we do on Earth.

Now, without any obstacles, we can derive the formula for the relativistic momentum, which will take the form of:

$$p_r = \frac{mv}{\sqrt[2]{1-\frac{v^2}{c^2}}}$$

When we substitute this formula for calculating the escape speed, we get:

$$\frac{mv^2}{2 * (1-\frac{v^2}{c^2})} = \frac{GMm}{R^2}$$

When we try to hypothetically substitute the speed of light as Schwarzschild did, we get infinity and zero radius Schwarzschild.

Therefore, taking into account time dilation, our patterns do not break down in the so-called event horizon.

Let's check what happens when we take into account the time dilation in the formulas for gravitational acceleration:

Standard pattern for gravitational acceleration:

$$g = \frac{GM}{R^2}$$

Time dilation must be included in the formula for acceleration:

$$a = \frac{s}{t^2}$$

After taking time dilation, we have the formula:

$$a = \frac{s}{t^2 * (1-\frac{v^2}{c^2})}$$

Thus, the relativistic figure of the acceleration will be a nice figure:

$$a = \frac{a_r}{(1-\frac{{v_r}^2}{{c_r}^2})}$$

v_r-relativistic velocity measured by an observer on an object flying at the speed of light;

a_r- acceleration which our observer registers;

c_r- speed of light calculated by our observer;

This is the subjective feeling of our traveler because he is constantly changing his inertial system by changing his speed. When it analyzes its speed, it grows to infinity, as well as its measurement of the speed of light and acceleration.

An external observer will notice, however, that our traveler will accelerate slowly and to calculate its acceleration, taking into account the dilatation of time which is subjected to, our traveler can analyze its speed or calculate the acceleration from the formula:

$$a_r = a * \left(1 - \frac{v^2}{c^2}\right)$$

Therefore, if we analyze the force taking into account the time dilation, we should also take into account time dilation.

The formula will have the form:

$$F = m * a * \left(1 - \frac{v^2}{c^2}\right)$$

Thus, the formula for gravitational acceleration is:

$$g * \left(1 - \frac{v^2}{c^2}\right) = \frac{GM}{R^2}$$

Conclusion:

From the formulas given above, it follows that if we take into account dilation of time in formulas as well as speed, energy and gravitational interactions, we get rid of paradoxes, peculiarities and most importantly dark matter.

We can transform patterns without fear that after transformations we fall into a paradox or singularity.