When G and M are Understood from a Deeper Perspective it Looks Like the Newtonian Field Equation Contains Time Dynamics

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Abstract

An argument often used to show that the Newtonian speed of gravity is infinite is that the Newtonian field equation (rooted in the Poisson equation) has no time derivative with respect to the gravitational potential. However, as the Newton gravitational constant G has not been well understood until recently, and also due to the fact one has not understood mass in the gravity formula that well, except from the surface level, we will demonstrate that, when understood from a deeper perspective, there is likely to be a concealed time derivative of the gravitational potential in the Newton field equation. This supports our recent claim that Newtonian gravity speed is consistent with the idea that gravity moves at the speed of light, not by assumption, but from calibration, and in a way that does not conflict with the equations one can derive from Newtonian theory.

Key Words: Newton field equation, Poisson equation, speed of gravity, time derivative, mass definition.

1 The Newton field Equation From a New Perspective

In gravity formulas one operates with the mass in terms of kg, often with the symbol m or M, for example in the Newtonian [1] gravity force formula and in the Newtonian field equation. To describe mass from a deeper perspective it would be nice to describe the kg mass from physics constants and variables that were related to the atomic scale. The reduced Compton [2] wavelength is given by $\bar{\lambda} = \frac{\hbar}{mc}$. This we can solve with respect to m, we then get

$$m = \frac{\hbar}{\bar{\lambda}} \frac{1}{c} \tag{1}$$

This we think is the simplest possible way to express the kg rest mass using the Planck constant, the reduced Compton wavelength and the speed of light, see [3, 4] for a detailed discussion on this. Furthermore, we [5] have claimed that the gravity constant is a composite constant of the form $G = \frac{l_p^2 c^3}{\hbar}$, simply by solving the Planck length formula of Max Planck [6, 7] for G . This would lead to a circular problem if we cannot find the Planck length independent of G, but this we can easily do, see [3, 8–10]. This means we have

$$GM = \frac{l_p^2 c^3}{\hbar} \frac{\hbar}{\bar{\lambda}} \frac{1}{c} = c^3 \frac{l_p}{c} \frac{l_p}{\bar{\lambda}} \tag{2}$$

where we, in a series of papers, have argued that $\frac{l_p}{c} \frac{l_p}{\bar{\lambda}}$ is an embedded mass definition – it is the incomplete kg mass definition transformed by G into a collision time [3] (rest) mass:

$$\bar{M} = \frac{l_p}{c} \frac{l_p}{\bar{\lambda}} = t_p \frac{l_p}{\bar{\lambda}} \tag{3}$$

we use the notation $\bar{M}$ to distinguish it from the standard kg mass M and m. If we now take the partial derivative with respect to the Planck time, we get

$$\frac{\partial \bar{M}}{\partial t_p} = \frac{l_p}{\bar{\lambda}} \tag{4}$$

So this means we also have

$$\bar{M} = t_p \frac{l_p}{\bar{\lambda}} = t_p \frac{\partial \bar{M}}{\partial t_p} \tag{5}$$

Next, let us look at the Newtonian field equation, it can be described by the Poisson equation in the well-known formula

$$\nabla^2 \phi = 4\pi G\rho = 4\pi G \frac{M}{V} \tag{6}$$

Then, let us replace G with $G = \frac{l_p^2 c^3}{\hbar}$ and M with $M = \frac{\hbar}{\bar{\lambda}} \frac{1}{c}$, this gives

$$\nabla^2 \phi = 4\pi G \frac{M}{V} = 4\pi c^3 \frac{\bar{M}}{V} = 4\pi c^3 \frac{t_p}{V} \frac{\partial \bar{M}}{\partial t_p} \tag{7}$$

So yes we have

$$\nabla^2 \phi = 4\pi c^3 \frac{t_p}{V} \frac{\partial \bar{M}}{\partial t_p} \tag{8}$$

which will give identical output predictions to the standard Newtonian field equation but, looking at it from this perspective, it looks quite different with respect to interpretation. We could claim time dynamics is embedded in the Newton field equation when one understands what G and M represent from a deeper perspective, which is very different to the standard view that the Newtonian field equation contains no time dynamics. Please also study [4] in detail as we have discussed the partial derivative of $\bar{M}$ with respect to time there in much greater detail, and even showed how to unify quantum mechanics and gravity in this paper. Moreover, other recent research seems to indirectly support our claim that mass is linked to time, see [11, 12]. It is not that we first claim that the Newtonian field equation does not have time dynamics and then claim it has time dynamics. We are first looking at the Newtonian field equation and asking, what do G and M ($\rho = M/V$) truly represent at a deeper level? Then we find that there is a more complete mass embedded in the Newtonian gravity force formula as well as carried over anywhere one has GM. This mass, which is a more complete mass than the kg mass, has dimensions of time, and it is linked to the Planck time in a way that any mass can be described as the Planck time multiplied by the partial derivative of the mass in question with respect to time. This is not something we invented just to factor in a time derivative into the Newtonian field equation, this is something we have discovered in an in-depth study of the foundations of physics, see [4].

This could have implications for our recently published view that Newton gravity is consistent with the idea that gravity moves at the speed of light, and is not instantaneous. As one, from just blindly looking at the Newtonian version of the Poisson equation, could claim, there are no time dynamics. It is first when one understands that the collision-time mass is what is concealed in GM that one is able to also see time dynamics is concealed in the Newtonian gravity.

The gravity potential can also be written as

$$\phi(r) = \frac{GM}{R} \tag{9}$$

And R, we have decided upon, does not change with respect to time, so we must have

$$\frac{\partial \phi(r)}{\partial t} = \frac{\partial \frac{GM}{R}}{\partial t} = \frac{c^3}{R} \frac{\partial \bar{M}}{\partial t} = \frac{c^3}{R} \frac{l_p}{\bar{\lambda}} \tag{10}$$

In other words, the Newtonian field equation embedded (concealed) potentially seems to also contain the change in gravitational potential with respect to time, that is to say time dynamics. We can write the Newtonian field equation as

$$\nabla^2 \phi = 4\pi R \frac{t_p}{V} \frac{\partial \phi(r)}{\partial t} = 4\pi c^3 \frac{t_p}{V} \frac{\partial \bar{M}}{\partial t} = 4\pi G\rho \tag{11}$$

This strongly supports our theory that Newtonian gravity moves at the speed of light, and not instantaneously as previously thought. If there were no time dynamics in the Newtonian field equation one could argue for the idea that this alone had to cause instantaneous (infinite speed) gravity, but we have demonstrated that, concealed in the field equation, there is also a time derivative of the gravitational potential hidden in the equation. We naturally do not mean it is hidden on purpose, but rather hidden in the entity GM that not has been understood well until recently. This would overturn several hundred years of assumptions about the Newtonian theory, so we are naturally open to constructive debate. However, we encourage the reader to study the papers we here have referred to before making hasty conclusions.

2 Conclusion

We have demonstrated that the Newtonian field equation can be seen in a new light based on recent developments in gravity and quantum physics. It seems as if it, concealed, also contains the partial derivative of the gravity potential with respect to time. This then supports our recent claim [10] that Newtonian gravity is consistent with the speed of gravity being the same as the speed of light, not by assumption, but by calibration to gravity observations.

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