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When the versatility of Mathematics must be looked with suspicion

Mathematic in itself is an highly intellectually rewarding activity, and the fact that it can be used to model physical phenomena must be considered an adaptation of this versatile Science, carefully valued by the physicist and not just a matter of fact, since the applications of mathematic-geometric nature cannot be automatic but only constitute exercises intended to reduce the load of information necessary to describe physical phenomena belonging to the universal reality.

In this activity the scientist who replaces the necessary intuitive effort with mathematics and geometries is deceiving himself and facing sure disaster as consequence.

In this paper I try to avoid the usual list of the unphysical perceptions introduced in the world of physics by unwise use of mathematics and concentrate my efforts around a simple mathematical exercise devised in the attempt to prove my affirmations.

The gravitational theory, which I used, determined the development of a formula describing the depression of the field of ESF surrounding a Large Gravitational Mass (M_{LGM}) and the conclusion was that the flow of ESF would invest a mass at rest over the said M_{LGM} causing in it the emergency of the Static Force.

In simple terms this is a more advanced application of Newton's Universal Law of Gravitation (ULG).

The ULG is used here to describe the gravitational phenomenon whilst taking into account the presence of a substance called Ether/ESF.

With it we consider the mass at rest to be the unit of mass and the depression function of the ether/ESF results to be P(r), in the point of existence of such unit of mass, and for r the radius of the surface of the M_{LGM} will be:

$$P(r) = c^2 - \frac{kM_{LGM}}{4\pi r}$$

In base of the theory presented, the static Force is caused by the flow of the fluidic substance ESF represented by the gradient of P(r) along r for $r=r_0$, where r_0 is the radius at the surface of the spherical mass M_{LGM} over which our unitary mass is situated.

It results that, the gravity is represented by this flow which is unstoppable due to the capacity that the gravitational mass M_{LGM} has, to continuously absorb the ESF and transform it into more mass gravitational as a component M_{RM} of the mass-energy which belongs to the M_{LGM} :

$$\left(\frac{dP}{dr}\right)_0 = \frac{d\left(c^2 - \frac{kM}{4\pi r_0}\right)}{dr} = \frac{kM}{4\pi r_0^2} = a(r)_0$$

If instead of applying the pure rule of derivation, developed through the limit for $(r_0 - r) \to 0$ of the function of depression P(r) , (whilst we accept for the moment the validity of the above physical justification) we use a mathematical approach, that starts with the following ratio, (for $r > r_0$):

$$\frac{P(r) - P(r_0)}{r_0 - r}$$

The situation in this case can be faced developing P(r) with the help of the series of Taylor - Mc Laurin for functions of one variable :

$$P(r) = P(r_0) + \frac{P'(r_0)}{1!}(r_0 - r) + \frac{P''(r_0)}{2!}(r_0 - r)^2 + \\ + \frac{P'''(r_0)}{3!}(r_0 - r)^3 + \ldots\ldots$$

Note: that we still use derivates of multiple order of the same function P(r) and the general formula for the derivates of P(r) is :

$$P^{(n)}(r) = \frac{kM}{4\pi}(-1)^{(n+1)}\ n!\, r^{-(n+1)}$$

The above Taylor series gives the formulation below :

$$\frac{P(r)-P(r_0)}{(r_0-r)}=\sum_1^n \frac{P^{(n)}(r_0)}{n!}(r_0-r)^{n-1}$$

Simplifying :

$$\frac{P(r)-P(r_0)}{(r_0-r)}=\frac{kM}{4\pi}\sum_1^n(-1)^{(n+1)}r_0^{-(n+1)}(r_0-r)^{n-1}$$

This expression for n=1 means that we stop our calculations to the first degree of approximation and gives again an approximated value of Newton's ULG:

$$\frac{P(r)-P(r_0)}{(r_0-r)}\cong\frac{kM}{4\pi r_0^2}=a(r_0)$$

Nevertheless the complete expression for the above ratio is:

$$\frac{P(r)-P(r_0)}{(r_0-r)}=a(r_0)\sum_1^n(-1)^{(n-1)}r_0^{-(n-1)}(r_0-r)^{n-1}$$

Which, expanded can be written:

$$\frac{P(r)-P(r_0)}{(r_0-r)}=a(r_0)\left(1-\frac{(r_0-r)}{r_0}+\frac{(r_0-r)^2}{r_0^2}-\frac{(r_0-r)^3}{r_0^3}+\ldots\ldots\right)$$

Resulting :

$$\frac{P(r) - P(r_0)}{(r_0 - r)} = a(r_0)\,\frac{1 - \left(\frac{r_0 - r}{r_0}\right)^n}{1 - \frac{r_0 - r}{r_0}}$$

Whose limit for $(r_0 - r) \rightarrow 0$ is $a(r)_0$.

This demonstration is not of physical practical value since the result was known from start, and is only intended to show that the role of mathematics when dealing with phenomena of physics, at times can result deceiving and to obtain practical results the formulations and mathematical adaptations must be short, since long mathematical passages can introduce all sort of errors, therefore the quest of Truth in physics needs accurate choices of the mathematical tools usually consisting of simple formulations and graphics.

Note: Paradoxically cannot be denied that passages involving mathematical transformations are a necessity for the physicist and even the above transformations, or transformations of similar nature, can in particular cases be of help.