Planck + Einstein on π-Day*
Fundamental Physical Constants in a Relativistic Perspective and The Design of a Black Hole Gun!

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Abstract

This paper show how we can "manipulate" physical fundamental constants like the Planck constants in Euclidean space-time. For example, what is the velocity we need to travel at for the π to disappear from the Planck length as observed from another reference frame? Or what is the velocity we need to travel at to replace π in the Planck energy with the Golden ratio Φ? Or what is the velocity we need to travel at to turn Planck's mass into "Gold"? This paper provides the answer to this and similar questions all quite natural to think about on π-day.

Key words: Einstein special relativity theory, Euclidian space-time, length contraction, length transformation, relativity of simultaneity, Planck length, Planck time, Planck mass, Planck energy, Black Holes.

1 Introduction

In a recent paper by Haug (2016), it is shown how one can move any constants like π from space and into velocity and thereby into time and vice versa. In this way we can transform any constant in space or time into another number. This paper follow‘s up on that paper and shows how we easily can "manipulate" physical constants like the Planck constant. It is well known from relativity theory that distances in space and time are affected by the velocity and the reference frame we are measuring from. This paper uses length contraction, length transformation, relativity of simultaneity, and time dilation under Einstein's special relativity theory to get a slightly different perspective on some fundamental physical constants.

This paper may be seen as trivial in a way, but we find it interesting how, for example, π can be removed from the Planck length or the Planck energy when we operate in Einstein space-time. We will not discuss whether or not Einstein's special relativity theory truly holds at extremely short distances such as the Planck length and over extremely short time intervals such as Planck time, nor will we draw conclusions on that here. In this paper we will assume that Einstein's special relativity theory is valid for any time interval and any length interval.

2 Removing π from the Planck Length

The Planck length is given by

$$l_p = \sqrt{\frac{\hbar G}{c^3}}$$

where $\hbar$ is the reduced Planck constant $\hbar = \frac{h}{2\pi}$. In other words, we can also write the Planck length as

$$l_p = \sqrt{\frac{\frac{h}{2\pi}G}{c^3}} = \sqrt{\frac{hG}{2\pi c^3}}$$

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Assume we have measured a Planck length on the embankment. Next we place a clock at each end of the Planck length and Einstein synchronize these two clocks. Each clock also has a time-release laser. What is the relative velocity we need to travel at relative to the embankment so that length transformation removes the π from the Planck length? This velocity is

$$v = c\sqrt{1-\left(\frac{\sqrt{\frac{hG}{2\pi c^3}}}{\sqrt{\frac{hG}{2c^3}}}\right)^2} = c\sqrt{1-\frac{1}{\pi}} \tag{1}$$

Haug (2016) has shown that this is the same velocity where we can remove π from the spatial challenge of Squaring the Circle. Also interesting is that at this velocity one second passing on the embankment will mean $\sqrt{\pi}$ seconds passing in the train.

3 Designing a mini Black-Hole Gun

The Planck rest mass is given by

$$m_p = \sqrt{\frac{\hbar c}{G}} = \sqrt{\frac{hc}{2\pi G}}$$

By accelerating a particle with this mass to $v = c\sqrt{1-\frac{1}{\pi}}$ then the mass as observed from the rest frame will be

$$m_v = \frac{m_p}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{\sqrt{\frac{hc}{2\pi G}}}{\sqrt{1-\frac{\left(c\sqrt{1-\frac{1}{\pi}}\right)^2}{c^2}}} = \sqrt{\frac{hc}{2G}}. \tag{2}$$

This π-less Planck mass has exactly $\sqrt{\pi}$ more mass than the Planck mass. This larger mass is exactly the same as the rest mass of a particle known as the Planck particle, which is hypothetically defined as a tiny Black Hole, according to modern physics. Obviously the accelerated mass above is not a rest mass, but a moving mass. Still, we could speculate (perhaps a bit wildly) that we have created a Black-Hole gun, where the bullets rest mass is the Planck mass and when shot out (accelerated) to $v = c\sqrt{1-\frac{1}{\pi}}$ the bullets will turn into mini Black-Holes. If the acceleration happens inside the barrel, the Black Hole will absorb the gun and hopefully leave the shooter intact. If so, then this could be the end to all wars. However, if the acceleration happens outside the barrel first, then we have to pray that the hypothesis of mini Black Holes is dead wrong.[1]

4 Turning π into the Golden ratio

At what velocity will π be length contracted to the Golden ratio $\Phi = 1.61803.....$? This happens at the following velocity

$$v = c\sqrt{1-\frac{\Phi^2}{\pi^2}} \tag{3}$$

To turn the Golden ratio back to π we will need to utilize length transformation rather than length contraction.

5 Turning the Planck Length into a Golden Planck length

Again assume we have measured a Planck length rod on the embankment and mounted a time-release laser clock on each end of the Planck length rod. We have Einstein synchronized the clocks and mounted a time-release laser at each end of the Planck length rod.[2] To transform the π in the Planck length into the Golden ratio $\phi = 1.61803.....$ we need to travel at the following relative velocity

[1] I would bet on the later!

[2] We will ignore the fact that we probably cannot make lasers with such high accuracy for now, as a thought experiment alone could still give us interesting insights in the fabric of space-time.

$$v = c\sqrt{1-\left(\frac{\sqrt{\frac{hG}{2\pi c^3}}}{\sqrt{\frac{hG}{2\Phi c^3}}}\right)^2} = c\sqrt{1-\frac{\phi}{\pi}} \tag{4}$$

At this velocity, two laser signals sent out simultaneously from each end of the Planck length rod will make marks on the train with the following distance apart:

$$l_{p,\phi} = \sqrt{\frac{hG}{2\Phi c^3}}. \tag{5}$$

6 Turning Planck Mass into Golden Energy

The Planck energy is

$$E_p = m_p c^2$$

where m_p is the Planck mass:

$$m_p = \sqrt{\frac{\hbar c}{G}} = \sqrt{\frac{hc}{2\pi G}}$$

which gives us the well known Planck energy of

$$E_p = m_p c^2 = \sqrt{\frac{hc}{2\pi G}}c^2 = \sqrt{\frac{hc^5}{2\pi G}}$$

From Einstein's special relativity theory[3] we know that the energy of a moving mass is

$$E = \frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}}. \tag{6}$$

Lets define Golden Planck energy as

$$E_g = \sqrt{\frac{hc^5}{2\Phi G}}. \tag{7}$$

That is the Golden Planck energy is the same as the Planck energy, but with π replaced with Φ. The velocity needed to get Golden Planck energy from the Planck mass is

$$v = c\sqrt{1-\frac{\Phi}{\pi}}.$$

This gives us the Golden Planck energy:

$$E_g = \frac{m_p c^2}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{\sqrt{\frac{hc}{2\pi G}}c^2}{\sqrt{1-\frac{\left(c\sqrt{1-\frac{\Phi}{\pi}}\right)^2}{c^2}}} = c^2\sqrt{\frac{hc}{2\Phi G}} = \sqrt{\frac{hc^5}{2\Phi G}}. \tag{8}$$

Further the Planck time is given by

$$t_p = \sqrt{\frac{\frac{h}{2\pi}G}{c^5}} = \sqrt{\frac{hG}{2\pi c^5}}$$

At velocity $v = c\sqrt{1-\frac{\Phi}{\pi}}$ a Planck second in one frame goes by for every Golden Planck second in the other frame, where the Golden Planck second is defined as

$$t_g = \sqrt{\frac{hG}{2\Phi c^5}}. \tag{9}$$

[3] See Einstein (1905, 1916).

7 Summary of Some Results

Below we have made a table summary of some of the results described above as well as some other trivial results. We have shown how to get π-less Planck constants and also how to replace π in the Planck constants with the Golden ratio or any other constant. From a relativistic point of view, the fundamental constants are possibly not as constant as first assumed?

Table 1: This table shows some interesting relative velocities needed to transfer an interesting constant to another interesting constant.

Transformation	Start result	Velocity needed	End result
Turning π length into Golden ratio length	π	$c\sqrt{1-\frac{\Phi^2}{\pi^2}}$	Φ
Turning π length into inverse Golden ratio length	π	$c\sqrt{1-\frac{\phi^2}{\pi^2}}$	ϕ
Removing π from the Planck length	$\sqrt{\frac{hG}{2\pi c^3}}$	$c\sqrt{1-\frac{1}{\pi}}$	$\sqrt{\frac{hG}{2c^3}}$
Removing π from the Planck energy	$\sqrt{\frac{hc^5}{2\pi G}}$	$c\sqrt{1-\frac{1}{\pi}}$	$\sqrt{\frac{hc^5}{2G}}$
Removing π from the Planck energy	$\sqrt{\frac{hc}{2\pi G}}$	$c\sqrt{1-\frac{1}{\pi}}$	$\sqrt{\frac{hc^5}{2G}}$
Removing 2π from the Planck energy	$\sqrt{\frac{hc}{2\pi G}}$	$c\sqrt{1-\frac{1}{2\pi}}$	$\sqrt{\frac{hc^5}{G}}$
Turning Planck mass into Planck particle equivalent mass	$\sqrt{\frac{hc}{2\pi G}}$	$c\sqrt{1-\frac{1}{\pi}}$	$\sqrt{\frac{hc}{2G}}$
Turning Planck energy into Golden ratio energy	$\sqrt{\frac{hc^5}{2\pi G}}$	$c\sqrt{1-\frac{\Phi}{\pi}}$	$\sqrt{\frac{hc^5}{2\Phi G}}$
Turning the Planck length into Golden-Planck lenght	$\sqrt{\frac{hG}{2\pi c^3}}$	$c\sqrt{1-\frac{\Phi}{\pi}}$	$\sqrt{\frac{hG}{2\Phi c^3}}$
Turning the Planck time into Golden-Planck time	$\sqrt{\frac{hG}{2\pi c^5}}$	$c\sqrt{1-\frac{\Phi}{\pi}}$	$\sqrt{\frac{hG}{2\Phi c^5}}$
Turning Planck energy into inverse-Golden ratio energy	$\sqrt{\frac{hc^5}{2\pi G}}$	$c\sqrt{1-\frac{\phi}{\pi}}$	$\sqrt{\frac{hc^5}{2\phi G}}$
Turning the Planck length into Golden-Planck lenght	$\sqrt{\frac{hG}{2\pi c^3}}$	$c\sqrt{1-\frac{\phi}{\pi}}$	$\sqrt{\frac{hG}{2\phi c^3}}$
Turning the Planck time into Golden-Planck time	$\sqrt{\frac{hG}{2\pi c^5}}$	$c\sqrt{1-\frac{\phi}{\pi}}$	$\sqrt{\frac{hG}{2\phi c^5}}$
Turning Planck energy into Golden-π energy	$\sqrt{\frac{hc^5}{2\pi G}}$	$c\sqrt{1-\frac{1}{\Phi}}=c\phi$	$\sqrt{\frac{h\Phi c^5}{2\pi G}}$
Planck constant to Reduced Planck constant	$\frac{h}{2\pi}$	$c\sqrt{1-\frac{1}{4\pi^2}}$	h

8 Conclusion

By using the method outlined in Haug (2016) article, we have shown how a series of fundamental constants in physics can be "manipulated" in Euclidian space-time. This is directly related to length contraction, time dilation, and relativity of simultaneity in Einsteins special relativity theory. A fundamental constant, the Planck length, for example, in one reference frame is not the same as observed from another reference frame. Thus, a Planck second in one reference frame is not a Planck second as observed from another reference frame. This is naturally obvious from Einstein's special relativity theory, still we have not seen much written on some special velocities that for example turn Planck mass into a π-less Planck energy or a Planck energy that contains Φ rather than π. Whether this has any deeper implications for physics, or if it only will entertain some people on π-day only space-time can tell.

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