

# Extracting the Speed of Gravity from A Grandfather Pendulum Clock

Espen Gaarder Haug

April 13, 2020

## Abstract

Based on recent development in quantum physics we show how to extract the speed of gravity (light) from a Pendulum Clock. This with no knowledge off the so-called Newton's gravitational constant  $G$ . This is a very short preliminary note with the mathematical results. We will likely at a later point extend this paper with an in-depth discussion.

**Key words:** Planck length, Compton wave, Pendulum clock, gravity.

## 1 Pendulum Clock to Find Speed of Gravity

A pendulum is basically a gravity clock. The Pendulum clock was supposedly invented by Christiaan Huygens in 1656. In 1673 Huygens publishes his theory on how to calculate the pendulum periodicity from gravity acceleration:

$$T = 2\pi\sqrt{\frac{L}{g}} \quad (1)$$

where  $L$  is the length of the Pendulum arm and  $g$  is the gravitational acceleration. Based on this combined with Haug's [1] insight in quantum gravity we can easily show that we must have

$$c_g = \frac{C\sqrt{L\bar{\lambda}}}{Tl_p} \quad (2)$$

where  $C$  is the circumference of the gravity object measured at the surface where the Pendulum clock stands,  $l_p$  is the Planck length,  $\bar{\lambda}$  is the reduced Compton wavelength of the gravity object (the Earth), and  $T$  is the pendulum periodicity. That is we find the speed of gravity  $c_g$  from very simple gravity observations only. This method needs the Planck length and physicists not well studied in our new quantum gravity theory can easily think this is just mathematical trickery. Max Planck [2, 3] introduced the Planck length in 1899 as a function of  $G$ ,  $\hbar$  and  $c$  by the following formula

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

So one could claim what we have is

$$c_g = \frac{C\sqrt{L\bar{\lambda}}}{Tl_p} = \frac{C\sqrt{L\bar{\lambda}}}{T\sqrt{\frac{G\hbar}{c^3}}} \quad (4)$$

However, this do not explain our method. It is important to realize the Planck length can be found totally independent on  $G$  as shown by Haug [1, 4, 5]. In the first of these paper references please carefully study the appendix before making prejudice conclusions. The Planck length is linked to the speed of light, but  $G$  is not needed to find the Planck length. That is we need the speed of light (gravity) to find the Planck length. The Planck length together with the speed of gravity  $c_g$  is the essence of gravity, this is also why we can extract the speed of gravity from a Pendulum clock when we know the Planck length. Newton also never used nor invented  $G$ , again see our paper on collision space time [1].

## Example of use of our formula

The circumference of the Earth is  $C = 2\pi r = 2\pi \times 6371000 \text{ m}$ . The Planck length is approximately  $l_p \approx 1.61 \times 10^{-35} \text{ m}$ . The reduced Compton length of the Earth is  $\bar{\lambda} \approx 5.89 \times 10^{-68} \text{ m}$ . Be aware the Earth do not have a reduced Compton wave, but each elementary particle have one, and this is the aggregated sum of these,

see [1]. Further we use a Pendulum with length 25 cm, and measure its periodicity to about one second. This gives us

$$c_g = \frac{C\sqrt{L\lambda}}{Tl_p} = \frac{2\pi \times 6371000\sqrt{0.25 \times 5.89 \times 10^{-68}}}{1 \times 1.61 \times 10^{-35}} \approx 301709683 \text{ m/s}$$

which is more accurate than they have measured the speed of gravity from using complicated theories combined with LIGO measurements on so called gravitational waves.

## References

- [1] E. G. Haug. Collision space-time: Unified quantum gravity. *Physics Essays*, 33(1):46, 2020. URL <https://doi.org/10.4006/0836-1398-33.1.46>.
- [2] M. Planck. *Natuerliche Masseinheiten*. Der Königlich Preussischen Akademie Der Wissenschaften, 1899.
- [3] M. Planck. *Vorlesungen über die Theorie der Wärmestrahlung*. Leipzig: J.A. Barth, p. 163, see also the English translation “The Theory of Radiation” (1959) Dover, 1906.
- [4] E. G. Haug. Can the planck length be found independent of big G ? *Applied Physics Research*, 9(6):58, 2017.
- [5] E. G. Haug. Finding the planck length independent of newton’s gravitational constant and the planck constant: The compton clock model of matter. <https://www.preprints.org/manuscript/201809.0396/v1>, 2018.