



[microreview]

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Measuring time in meters

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Abstract

This is a microreview of the natural system of units for pedagogical purpose.

keywords: natural system of units, special relativity, time, meters

The most updated version of this white paper is available at

<https://osf.io/4ntwu/download>

Introduction

1. In the International System of Units (SI), the velocity of light in vacuum is, approximately, $3 \cdot 10^8$ m/s [1].
2. The Natural System of Units is overwhelmingly useful in Quantum Field Theory calculations [2], whereas the SI is usually used in the context of classical physics.

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What does $c = 1$ mean?

3. Let's consider (2) hereafter.
4. The measurement of time is accomplished by means of the distance that light travels in vacuum [3].
5. 1 second is the time required for light to travel $3 \cdot 10^8$ m.
6. Thus, 1 second in SI is equivalent to $3 \cdot 10^8$ m in the natural system of units.
7. For short, NSU = Natural System of Units.
8. Let's calculate the light speed in the NSU.
9. Consider that light in vacuum travels the distance $\Delta x = 3 \cdot 10^8$ m.
10. Then, $c = \frac{\Delta x}{\Delta t} = \frac{3 \cdot 10^8 \text{ m}}{\Delta t}$.
11. Recall, from (6), that $\Delta x = 3 \cdot 10^8$ m, then $\Delta t = 1 \text{ s} = 3 \cdot 10^8$ m.
12. Substituting $\Delta t = 3 \cdot 10^8$ m in (10), $c = \frac{3 \cdot 10^8 \text{ m}}{3 \cdot 10^8 \text{ m}} = 1$.
13. So, in the NSU, $c = \frac{1 \text{ m}}{1 \text{ m}}$, or simply $c = 1$.
14. Einstein's equation, $E = mc^2$, becomes $E = m$.

Final Remarks

15. We presented the physical motivation and meaning for $c = 1$.
16. The Natural System of Units is developed from a natural phenomenon, that is, the speed of light.

Open Invitation

Review, add content, and co-author this white paper [4, 5].

*Join the **Open Mathematics Collaboration**.*

Send your contribution to `mplobo@uft.edu.br`.

Open Science

The **latex file** for this *white paper* together with other *supplementary files* are available in [6].

How to cite this paper?

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+ **Open Science Framework**

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+ **Zenodo**

`https://zenodo.org`

Agreement

17. All authors **agree** with [5].

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