Übergrad: A Theoretical Mathematical Concept

(In English: Super Degree; Function symbol: Ü or Φ)

Bryan Angelo
b**********3@gmail.com
https://github.com/angeloped
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Abstract. A new mathematical concept is proposed in the hope that it will be useful besides another theory of the author from which it was originally created. The Planck unit of length has a major role on the unit conversion for the Classical and Quantum geometry which appertains angular plane. There are two types of unit that are subject to conversion, Übergrad unit and Classical unit (degree unit). These two unit conversion functions can be useful for calculating angles with high precision. The new concept of angular equation of the Undergrad unit is based on the Planck units—it's a natural unit—which means the equation has a basis on the universal physical constants; a real property of space.

1. Introduction

The Übergrad unit (Borrowed from German language; which translates to: "Super Angle", "Super Degree", "Beyond Angle", or "Superdegree") is a proposed unit of measurement for converting "classical" plane angle to the equivalent Planck unit of length. As in Max Planck's proposal of system of units, the new concept of angular equation of the Übergrad unit is based on the Planck units—a natural unit[1]—which means the equation has a basis on the universal physical constants; a real property of space that actually exists and is not made out of the social agreements to be treated as the standard unit of measurement. This is the another concept of angular unit besides Degree and Radian. The concept of Übergrad yields no fixed angle values for different mathematical problems. It may seem counterintuitive to think that the Übergrad unit changes the angular measurements depending on the length of any of the two rays that creates a figure of an angle. But for every big changes, it yields a more precise equivalent value of an angle despite having a non-uniform value.

ALTHOUGH THE PLANCK LENGTH IS KNOWN TO BE THE SHORTEST POSSIBLE LENGTH, THE AUTHOR IS NOT CONVINCED THAT THIS IS FUNDAMENTAL AND THE BASIS OF THE ÜBERGRAD UNIT MAY CHANGE IN THE FUTURE WHEN A SCALE SMALLER THAN THE PLANCK LENGTH IS EMPIRICALLY PROVEN.

The *planck unit* of an *arc length* will serve as a substitute for the full rotation 360° degrees, the angular degree unit whose full rotation angle is defined as 360° could not precisely be measured. The only thing that motivates the author to do this is that the classical angular measurement is not compatible for his another theory, the said theory needs to be subjected to a quantisation process of an arc length to determine its precise angle, thus precision will give compatibility for it. And this is how the new mathematical concept was created. Although, its usage has its limitations, i.e., it will not fit for measuring classical problems but it is a useful way of achieving precise angular measurements through approximation of a quantised classical arc length. Why Übergrad

instead of Degree? In the author's another theory, he cannot use the concept of measurement of a plane angle in which one full rotation of a plane is popularly known to have its fixed value of 360°. The new idea is that the fixed value of one full rotation the 360° will be replaced by the arch length in converted to Planck length—acting similarly with the Degrees of an angle—for some "theoretical" purposes.

This concept is mainly created for one of the hypothetical building blocks of the core theory of consciousness that the author has been attempting to solve, calling it qualia strings or *q-strings*. The mathematical concept is neither a direct proof nor a solution to the problem of the said core theory, but rather it is just a theoretical tool of measurement for the tiniest angle applicable only for quantum geometry, that may help the author attempt to visualise how a metaphysical phenomenon could be formed with this mathematical approach. Although this is created for his core theory, the focus of this paper is not necessarily about the theory that the author has been working on, it may also be useful for other purposes such as the conversion of the *arc length* of a measured in degrees (0°–360°) to its corresponding planck unit of length and so forth.

2. The Planck Length

A German physicist Max Planck proposed a system of natural units, one of his work is a unit of length called the *Planck length*[2]. The *Planck length* (ℓ_p) is thought to be the smallest possible length and no smaller than it would ever be possible to measure or be determined[3]. But that does not mean that there is no length shorter than the Planck length.

Formula:[4]

$$\ell_p = \sqrt{\frac{\hbar G}{c^3}} = 1.616255 \times 10^{-35}\ m$$

Constants:

reduced planck constant:[5]

$$\hbar = 1.05457181710^{-34} Js$$

speed of light:[6]

$$c = 299,792,458 m/s$$

gravitational constant:[7]

$$G = 6.67430 \times 10^{-11}\ \frac{N \cdot m^2}{kg^2}$$

3. The Fundamental Übergrad

The C_p is called the Planck circumference, a mathematical concept, and is also the full rotation of the Übergrad unit, although this is not considered an "angle" because it contains only 1 Planck length in the circumference with an expected remainder or error. Since the rule of Übergrad is to follow the polygon property, it needs to fit 3 or more Planck length in a C_p .

$$C_p = \pi\ell_p = \tfrac{1}{2}\tau\ell_p = 5.0750407 \times 10^{-35}\ m$$

An alternative solution to the problem since there is only 1 Planck length in the C_p of the Fundamental Übergrad, it needs to apply the Degree measurement (0°–360°) for determining the full rotation angle that in the Übergrad unit could not be possibly determined.

$$\phi_p = \frac{C_p}{360} = 1.4097335278 \times 10^{-37}\ m$$

The variable Φ_P contains the value of full rotation divided by 360, it's classical; however, the author just demonstrated that in order to eliminate error, classical calculation must be applied. That must eliminate the error but the 360 (degrees) is impractical since the only focus of this concept must be based on the natural units. Why does not the first equation considered an angle? It can be considered but, it violates the Planck length requirement that it must contain more than 3 of that length, plus a remainder or error. It's just a rule to follow; however, it might still change.

NOTE: The unit "*m"* can also be replaced by "*Ü"* symbol when presenting an Übergrad angle, just like " ° " as for degrees and "*rad*" as for radians. The mathematical constant "τ" (tau) is twice the value of pi "π".

4. Classical and Planck Übergrad Conversion

These equations for the unit conversion are the methods of the conversion. There are two types of conversion: (a.) ***Classical–Planck Übergrad -*** Conversion from a measured degrees angle to its equivalent value in Planck unit; (b.) ***Planck–Classical Übergrad -*** From the equivalent converted Planck value to the value of the classical arc length (as angle).

Classical–Planck Übergrad:

$$\phi'_{pc}(\theta, \ell) = 2\pi\ell \left(\frac{\theta}{360}\right) 9.223 \times 10^{18}$$

Planck–Classical Übergrad:

$$\phi'_{cc}(\phi'_{pc}, \ell) = \frac{\phi'_{pc}}{\ell} \times \frac{1}{9.223 \times 10^{18}}$$

Legends:

ℓ - Classical length (in meters)
θ - Theta; classical angle (in degrees °)
Φ_{pc} - Planck Conversion (*pc*)
Φ_{cc} - Classical Conversion (*cc*)

The Übergrad angle changes depending upon the length: when length of ray is shorter, the angle increases its gauge quantity; and when it is shorter, the gauge will decrease but it should never be shorter than the Planck length itself.

5. Determine Percent Error

In the Fundamental Übergrad, extra lengths can be determined, these lengths appeared to be shorter than the Planck length, and this is a problem. If such error exists, and results are smaller than the Planck length, this is called a "remainder" or "error". Error violates the Planck units. There are two equations below that can determine the remainder and percent error associated with the remainder and the Planck circumference "C_p".

Remainder

$$\phi_r(\phi'_{pc}) = \left|\phi'_{pc} \mod \ell_p\right|$$

Calculating Error

$$\%\phi_{err}(\phi'_{pc}) = \frac{\phi'_{pc} - \left|\phi'_{pc} \mod \ell_p\right|}{\phi'_{pc}}$$

Legends:

Φ_r - Planck Conversion (remainder)
$\%\Phi_{err}$ - Planck Conversion (percent error)

The remainder "Φ_r" is the extra length shorter than Planck length resulted from the calculation of the circumference, while the percent error "$\%\Phi_{err}$" is the percent comparison of the remainder (yielded from the modulus operation) with the total Planck circumference "C_p".

6. Conclusion

The Übergrad unit ("Super Degree" or "Beyond Degree") is a suggested mathematical concept for calculating angle besides Degree and Radian. Unlike the two mentioned units, Übergrad unit is based on the natural units, which also means the measurement is not a math concent and is based on the universal physical constants. This unit has two symbols: "Ü" or "Φ". The Übergrad angle changes depending upon the length: when length of ray is shorter, the angle increases its gauge quantity; and when it is shorter, the gauge will decrease but it should never be shorter than the Planck length. The "error equation" indicates that the remainder from the modulus operation of the Planck circumference "C_p" and the Planck length. This concept is not yet completed due to lack of evidence of determining the length smaller than Planck unit of length. Despite for it being incomplete, it will be followed by a hypothetical theorem based on this concept as well.

References

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