Constants of Nature, Dynamics of Time

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Abstract

An archetypal model for the constants of nature is found from the ancient geometry of the the Cosmological Circle and is related to Plato's cosmology, with its dynamics and harmonics of time cycles. The inverse fine-structure constant and the proton-electron mass ratio are calculated, connecting fundamental mathematical constants of geometry with the latest theoretical and experimental values of these physical constants. Continuing in the tradition of George Gamow's suggestion, "Since the works of Sir Arthur Eddington, it has become customary to discuss from time to time the numerical relations between various fundamental constants of nature. Although until today such discussions have not led to any practical results - that is, to any valuable road signs toward further development of the theory of the still unclear fundamental facts in physics - it may be of some interest to survey the present status of this 'clairvoyant' branch of science."¹

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1 Introduction

From ancient times harmonic proportion was considered to mediate between basic dualities of nature such as finite/infinite, part/whole, etc., and number itself was a phenomena of time and energy [2]-[5]. Today we have a more advanced mathematical language that has been developed over the centuries, the errors of Aristotle's physics have mostly been corrected, and what remains incomprehensible has largely been forgotten [6]. Recently, mathematician Andy Hone has said, "The whole of physics can be described by the equation $\delta S = 0$ " [7]. Beginning as something of a play on Feynman's $U = 0$ equation for unifying physics, Hone then gets serious and explains the principle of least action.

The principle of least action belongs to the general class of variational principles which include the principle of least time [8]. Finding the “action” S is common to almost all branches of physics except perhaps the “clairvoyant” branch, where some say there is no action. At the foundation of the calculus of variations is the brachistochrone problem and the cycloid curve as its solution. The cycloid, a curve traced by a point on the circumference of a rolling circle [9] and given its name by Galileo, was the most studied curve in the 17th century; and was so controversial it was often called the “Helen of Geometers.” Simon Gindikin says, “What was most striking was that the cycloid appeared again and again in the solution of very different problems where it was not a part of the original formulation” [10].

What is also interesting about the cycloid is that from the equation for the the y coordinate, $y = r - r \cos t$, for a circle of radius $r = 1$, and $t = 3\pi/7$, $y \simeq 0.7774 \simeq 2\pi/8$ and $y/2 \simeq 0.3887$. As we shall see, this is the heptagon “squaring the circle.” $C = 2\pi r = 2\pi$ for $r = 1$, 2π is the length of the base of an arc for $t = 2\pi$, and the arc length is 8. So this cycloid has a period of 2π . A circle with $r = 1$ inscribes a square with a perimeter $= 8$. A circle with $r = y$ inscribes a square with a perimeter $8y \simeq 8 \times 2\pi/8 = 2\pi$, the approximate perimeter of the square which “squares the circle” with $r = 1$. The heptagon can be closely approximated by the hexagon geometry, and both are seen in the Cosmological Circle. Now we present the “constants of nature” [11]-[18].

2 Constants from the Cosmological Circle

Harmonic formulation of fundamental constants from archetypal geometry was shown previously [19]. The Pythagorean Table/Cosmological Circle encodes the harmonic compositions of the speed of light constant, gravitational constant, Planck’s constant, fine-structure constant, the electron mass, and proton mass. Here we calculate dimensionless constants, considered to be more “fundamental” than others.

Central to the Cosmological Circle is the harmonic of 6, and Plato’s perfect number, $1 + 2 + 3 = 1 \times 2 \times 3 = 6$. For Plato, number was an expression of time and related to the geometric ideas that existed before physical creation [2]. With a different meaning, 10 was the Pythagorean perfect number, $1 + 2 + 3 + 4 = 10$. Harmonics in this classical viewpoint help reveal how static geometry is connected with dynamic geometry.

The Cosmological Circle is the groundplan for many ancient monuments and temples [20]. $3888 = 27 \times 144$ is the numerical association for the New Jerusalem, another name for the Cosmological Circle. The harmonics of 3888 have a prolific link with other significant harmonics found in the Cosmological Circle [21]. The heptagon and hexagon (usually shown as a star heptagram and a double of the hexagon, a star dodecagram) are the main regular polygons in the Cosmological Circle.

In the Cosmological Circle, the half diagonal of the square which “squares the circle” that circumscribes the heptagon, is 7.778 , $5.5^2 + 5.5^2 \simeq 7.778^2$, and $7.778/2 \simeq 3.889$. $7/1.8 \simeq 3.889$, the chord of a heptagon with side equal to one is $\simeq 1.8$. And $(\cos(2\pi/7))^2 \simeq 0.3887$, square of the x_1 solution for constructing a heptagon, $8x^3 + 4x^2 - 4x - 1 = 0$ [22]. $14.4\phi/6 \simeq 3.883$ and $\pi/5\phi \simeq 0.3883$ for an approximate heptagon con-

struction where ϕ is the golden ratio, $\phi = (1 + \sqrt{5})/2$ [19]. Also, $60 \times 60 \times 360 = 1296000$, seconds of arc in a circle; the “sovereign number” of Socrates described in the mathematical marriage allegory of Plato’s *Republic*. This is interpreted as a “tonal index” of the allegory, and 3888 is one of the significant harmonic tone numbers [5]. $3 \times 1296 = 3888$. 1296 is the third octave harmonic of the “phi tone” 162, $8 \times 162 = 1296$ [21].

The main square of the Cosmological Circle is the basic Earth square with a perimeter of $4 \times 11 = 44$. The circle with an inscribed regular heptagon, or star heptagram, has a radius of $r = 7$. The 144 “light harmonic” as angular measure, is associated with the harmonics of the circle, $14.4^\circ \times 60'/1^\circ = 864' = 4 \times 216' = 8 \times 108' = (144 \times 360)''$. $8 \times 1.8 = 14.4$. $60 = 27 + 33$, the time harmonics. 27 is considered the outward time harmonic, and 33 is the inward time harmonic. From William Conner’s view of time, “If time is what separates the object/events of space in terms of outward sensing, it is the other way around with inner sensing. In memory, each object/event becomes a time point in the firmament of inner space” [21]. This inward sensing is a focus toward causal relations akin to the enfolding of Bohm’s implicate order [23] or Jung’s archetypal process [24], and represents a turnabout by the observer through π radians or 180° , see Eq. (2). $27 \times 144 = 3888$, $3888/33 = 1296/11$. 1296 is a harmonic of half the Sumerian precessional cycle, a cycle of Plato’s aionic time, and a harmonic of the “sovereign number” of Socrates [5] thought by some to have been brought back to Greece by Pythagoras [25, 26]. 11 is the side of the basic Earth square in the Cosmological Circle. $1.296^2 \simeq 1.93/1.15$, dodecagon radius ($r_d = \sqrt{2 + \sqrt{3}}$) divided by the heptagon radius ($r_h = 1/(2 \sin(\pi/7))$). $1.93 \simeq \pi/\phi$, $8 \times 144 = 1152$, $108^2 + 144^2 = 180^2$, $12 \times 108 = 1296$, and $3 \times 3888 = 108^2$.

3 Inverse Fine-Structure Constant $1/\text{Alpha } \alpha^{-1}$

The fine-structure constant determines the strength of the electromagnetic interaction [27], and was introduced by Arnold Sommerfeld. The fine-structure constant presents a challenge to determine its numerical value from theoretical considerations and discover the deeper fundamental relationship that it suggests for physical theories [19, 27]. Vár-laki, Ná-dai, and Bokor state that since “1910 the demand has arisen, beside the definitive calculations and spectroscopic measurements, to determine the ‘true value’ of the fine structure constant on a geometric basis, first of all using the value of π . This concept in a certain measure was intuitively advanced by Einstein” [28].

$\alpha^{-1} = \hbar c/e^2$ in cgs units. $\hbar = h/2\pi = h\text{-bar}$, the reduced Planck’s constant, c = speed of light constant, e = elementary charge.

$\alpha^3 \simeq 3.886 \times 10^{-7}$ and $3.888/3 = 60^4 \times 10^{-7} = 1.296$, the “sovereign number” harmonic [5]. Now we can see the harmonics of the Cosmological Circle in the calculation of α^{-1} .

$$\alpha^{-1} \cong 60H_5 + (360 - 120^{-1})10^{-4} \cong 137.035\,999\,16 \quad (1)$$

The H_5 harmonic number is the sum of the first five terms of the harmonic series, $1 + 1/2 + 1/3 + 1/4 + 1/5 = 137/60$ [19]. $60 + (7 \times 11) = 137$, also from the Pythagorean triangles of the Cosmological Circle $4^2 + 11^2 = 137$. Between 120 and 180 is the harmonic

mean $(2AB/(A+B))$ of the fundamental 144, “light harmonic” [19, 21]. The 120 and 180 harmonic are also significant angular measures. $120 \times 270 = 180^2$, where 270 is the “tone of action” [19, 21]. $2.16 \times 10^4 =$ harmonic of the minutes of arc in a circle, 60×360 .

$$\alpha^{-1} \cong 4\pi^3 + (1 - \pi_r^{-2})\pi^2 + \pi \cong 137.035\,999\,16 \quad (2)$$

$$NIST\,2002\,[29]\,\alpha^{-1} = 137.035\,999\,11\,(46)$$

π_r is the harmonic of π radians = 180. See [21] for more about the harmonic of 180. In our previous article [19] two more formulations for inverse alpha from the Cosmological Circle also have the same value of 139.035 999 16. The latest theoretical [30] and experimental [31] results have an average value of 137.035 999 168.

For the volume of an n-dimensional hypersphere see [32]-[36]. From McDonald’s formula for even volumes of an n-dimensional hypersphere [37], $V_n = \pi^{n/2} R^n / n/2!$ and if we consider $V_2 = \pi$, $V_4 = \pi^2$, $V_6 = 4\pi^3$ then solve for the total of $R_{v2} + R_{v4} + R_{v6} = R_t \simeq 1.93 \simeq \pi/\phi$. This is the approximate radius of the dodecagon with a side equal to one. Odd values of n (3, 5, 7) give the approximate radius of the dodecagon in-circle.

Wolfgang Pauli had one of the deepest understandings and curiosity about the importance of the fine-structure constant and spectra, as the Pauli/Jung letters reveal [38]-[40]. The equation in the form $4\pi^3 + \pi^2 + \pi$ for inverse alpha was noted by Peter Stanbury [41]. According to Carl Jung, the World Clock representing this equation was Pauli’s “great vision.” The World Clock could be thought of as a three or four dimensional version of the Cosmological Circle. $\pi^3 + 1 \simeq 4 \times 8 = 32$, divisions on the vertical face of Pauli’s World Clock. Várlaki, Náday, and Bokor show how deeply Pauli was involved with the symbolic associations of this equation in an archetypal quest for a resolution to his conflicts between the cognitive styles of Kepler and Fludd.

Abstract: In this paper we analyze in detail the central role of number ‘137’, the so-called Fine Structure Constant in the collaboration of Pauli and Jung. First, we present the fascination or the obsession of Pauli for the interpretation of number ‘137’. Second, we treat the spontaneous messages originating from unconscious concerning number ‘137’ in the well known dreams of Pauli. We restrict our investigations to the dreams containing the especially important formulae of Fine Structure Constant ($4\pi^3 + \pi^2 + \pi$), and also that containing the so-called background models of mathematical control systems. Third, we shortly mention four of the numerous synchronicities arising during the Pauli–Jung collaboration [28].

The inversion of π radians we have added to the “Pauli-Stanbury equation” is also consistent with the process described by Pauli. Beside the reflecting aspect of the axis, the blackbird of the World Clock is a symbol for “withdrawal from the world” or the “turning inward” characteristic of introversion, and part of Conner’s “inward time” or Pauli’s “background physics.” Of possible interest in relation to other approaches with higher dimensional volumes, relating symmetric spaces with momentum space; Heisenberg [42], Wyler [43], Smith [44], Gonzalez-Martin [45], Smilga [46]. Others have helped with the mathematics involved [47]-[50].

4 The Proton-Electron Mass Ratio m_p/m_e

$$m_p/m_e \cong 6\pi^5 + (\pi^3 - (\pi/\alpha)^{1/2}/10)^{-1} \cong 1836.152\,673 \quad (3)$$

$$NIST\,2006\,[51]\,m_p/m_e = 1836.152\,672\,47\,(80)$$

$(\pi/\alpha)^{1/2}/10 \simeq \phi_f/\phi \simeq 1.44^2$. ϕ_f is the reciprocal Fibonacci constant [19].

Again from the even hypersphere volume $V_n = \pi^{n/2} R^n / n/2!$ and where $V_{10} = 6\pi^5$ the $R_{10} \simeq 3.88 \simeq 2\pi/\phi$, approximate diameter of the dodecagon with a side equal to one. This is approximately twice the total R_t from above for the alpha equation. The odd, $n = 11$, value for R_{11} is approximately the diameter of the dodecagon in-circle. The harmonic of electron mass and proton mass also have a geometric formulation from the Pythagorean triangles of the Cosmological Circle [19]. Beside connections with the harmonic mapping of Fibonacci vortices from the Pythagorean Table/Cosmological Circle [19], these volume/radius results raise some interesting questions in relation to current dimensional theories in physics [52]-[55]. $6\pi^5$ was found by Lenz [56], Good [57, 58], Wyler [43], Stanbury [41], and physically explained by Gonzalez-Martin [59]. Related to the mathematics involved Macus Cohen asks, “Why should the reflection groups - the same groups that classify resolvable singularities, regular polyhedra, Lie algebras, quivers, frieze patterns, honeycombs, crystals, and caustics - classify the elementary particles? Because they all arise from the generic structures of singularities in flows.” Then he explains, “Using the volume in spin space as the action, the particle masses emerge” [60]. And we’re back to the action of squaring the circle, cubing the sphere, or maybe hypercubing the hypersphere.

5 Conclusion

We have presented some perspectives of time in an archetypal model for the constants of nature, including an essential aspect of the Cosmological Circle as a “squaring of the circle.” Related to this are the Pythagorean elements in the number theory of Johann Balmer, who curiously enough wrote his dissertation on the cycloid for his doctorate at the University of Basel [19, 61, 62]. Jan Boeyens and Demetrius Levendis, in *Number Theory and the Periodicity of Matter*, extend the ideas of Bohr and Balmer (from which Sommerfeld deduced the fine-structure constant) finding a numerical basis for periodic classification [62]. Their work has practical application in chemistry and physics. For a more advanced theoretical view of current research with number theory see the relatively new journal, *Communications in Number Theory and Physics*. And finally, for other perspectives on the nature of time see [63]-[78].

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