ON THE COSMIC NUMBER CONTINUED

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Richard Feynman: “There is a most profound and beautiful question associated with the observed coupling constant, e – the amplitude for a real electron to emit or absorb a real photon. It is a simple number that has been experimentally determined to be close to 0.08542455. (My physicist friends won’t recognize this number, because they like to remember it as the inverse of its square: about 137.03597 with about an uncertainty of about 2 in the last decimal place. It has been a mystery ever since it was discovered more than fifty years ago, and all good theoretical physicists put this number up on their wall and worry about it.) Immediately you would like to know where this number for a coupling comes from: is it related to pi or perhaps to the base of natural logarithms? Nobody knows. It’s one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by man. You might say the “hand of G-d” wrote that number, and “we don’t know how He pushed his pencil.” We know what kind of a dance to do experimentally to measure this number very accurately, but we don’t know what kind of dance to do on the computer to make this number come out, without putting it in secretly!” (1). In this note, a “computational dance” from which this number emerges without any need to put it in secretly is identified...

The fine-structure constant- α -is derived from the measurement of the ratio $\frac{\hbar}{m R_b}$ between the Planck constant and the mass of the R_b atom because

$$\alpha^2 = \frac{2 R_\infty}{c} \frac{m R_b}{m_e} \frac{\hbar}{m R_b}$$

where m_e is the electron mass. The recommended CODATA value is

$$\alpha = 7.2973525664 \times 10^{\wedge}-3 = \frac{1}{137.036} = \left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1.00009}{1^{12}}-\int_1^1 \frac{1.00009}{1^{12}}\,dn\right)}\right)^2\right)^2$$

Let

$R_\infty =$ the Rydberg constant
$e =$ the elementary charge
$\hbar =$ the reduced Planck constant
$c =$ the speed of light in a vacuum
$\epsilon_0 =$ the electric constant
$\mu_0 =$ the magnetic constant
$R_K =$ the von Klitzing constant
$Z_0 =$ vacuum impedance

And let

$$g = \text{the Gibbs constant} = \int_0^\pi \frac{\sin(x)}{x}\,dx$$

It follows that

$$\sqrt{\frac{2 R_\infty}{c} \frac{m R_b}{m_e} \frac{\hbar}{m R_b}} = \frac{e^2}{4\pi\epsilon_0 \hbar c} =$$

$$\frac{1}{4\pi\epsilon_0} = \frac{e^2}{\hbar c} = \frac{\pi\mu_0}{4}\frac{e^2 c}{\hbar} = \frac{k_e e^2}{\hbar c} = \frac{c\mu_0}{2 R_K} = \frac{e^2}{4\pi}\frac{Z_0}{\hbar} = \frac{1}{\frac{\left(\frac{3\pi}{2}\right)^3 g}{\sqrt{2}}} = \left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1.00009}{1^{12}}-\int_1^1 \frac{1.00009}{1^{12}}\,dn\right)}\right)^2\right)^2$$

Let

$G =$ the gravitational constant

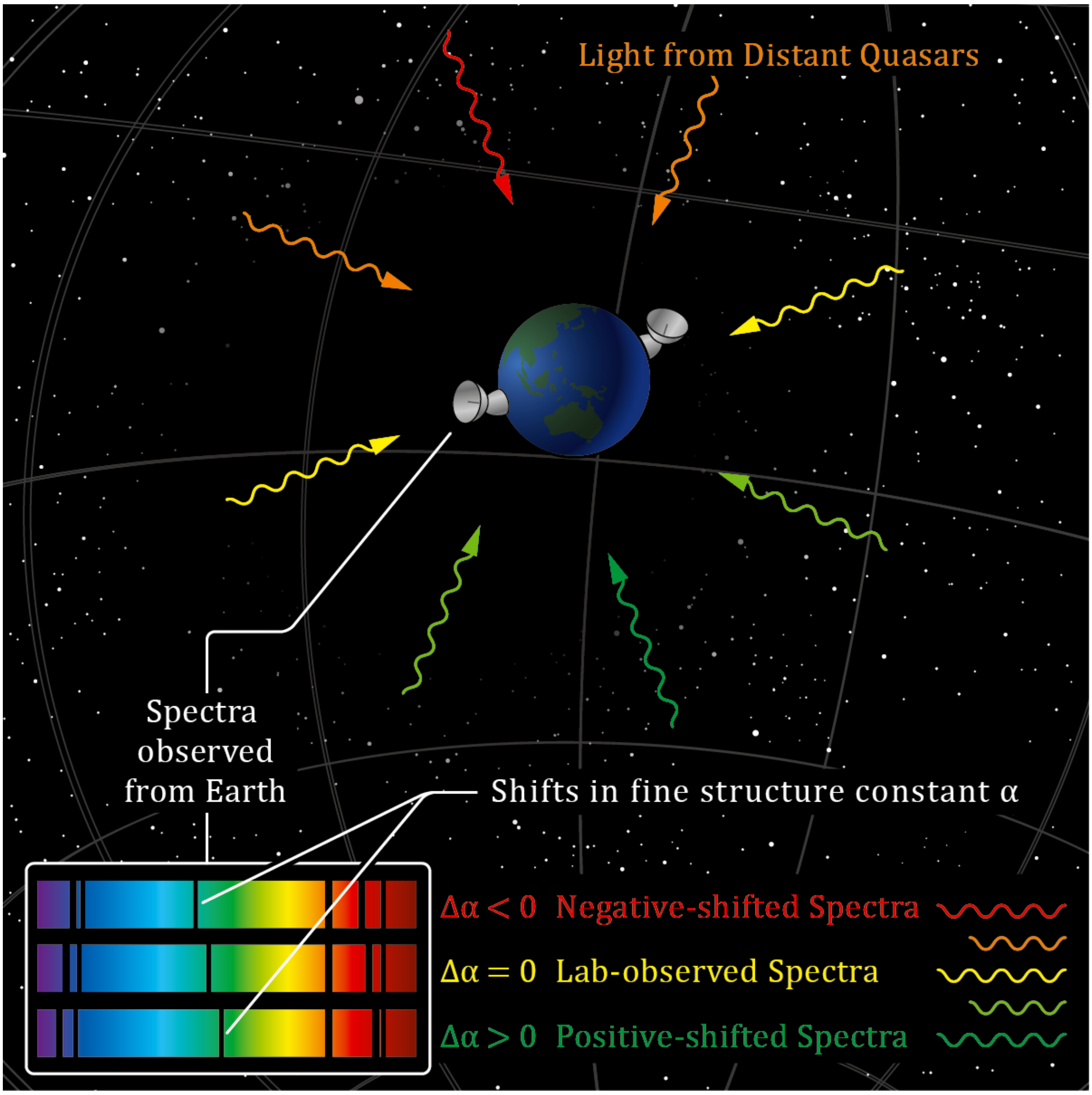
and

$$\alpha_G = \frac{G m_e^2}{\hbar c} = \text{the gravitational coupling constant} \approx 1.7518 \times 10^{\wedge}-45$$

In Planck units

$$\alpha_G\left(\left(\frac{e}{m_e}\right)^2\right)=\left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2-e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1.00009}{1^{12}}-\int_1^1\frac{1.00009}{1^{12}}\,dn\right)}\right)^2\right)^2$$

There is a difference of 0.0000127295 between the recommended value of α and $\left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2-e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1}{1^{12}}-\int_1^1\frac{1}{1^{12}}\,dn\right)}\right)^2\right)^2$, but this value has changed over the decades, it is dependent on many assumptions, and positive and negative variations in the fine-structure constant of one part in 100, 000 are suggested by data on quasar absorption lines (2 - 4).



The *General Theory Relativity* in its present form says that space-time is curved by mass (5). It follows that, in the beginning, all the mass of that universe was concentrated into a zero-dimensional point. That this idea is *a half-truth* is suggested by the implication of multiple singularities (at the centers of black holes) (6), the lack of a coherent mathematical framework for both large scale and small scale objects (7), and by the flat rotation curves of distant galaxies (8). A similar idea about the beginning-state that *doesn't* carry any absurd consequences is the idea of the infinite compression of *energy (light)*, and the *elimination of mass*. Now curvature is to be attributed, not to mass - which is a combination of light and space- but to *imbalances* of light and space. Mathematically, we capture what it is to be balanced, and what it is to *depart* from balance, thereby producing curvature, by re-expressing the tradition equation for a circle of area 1 ($\pi \sqrt{\frac{1}{\pi}}^2 = 1$) as

$$\lim_{x\to\infty} e^{2\gamma}\left(\sqrt{\frac{1}{e^{2\left(\sum_{n=1}^{x}\frac{1}{n}-\int_{1}^{x}\frac{1}{n}\,dn\right)}}}\right)^{2} = 1$$

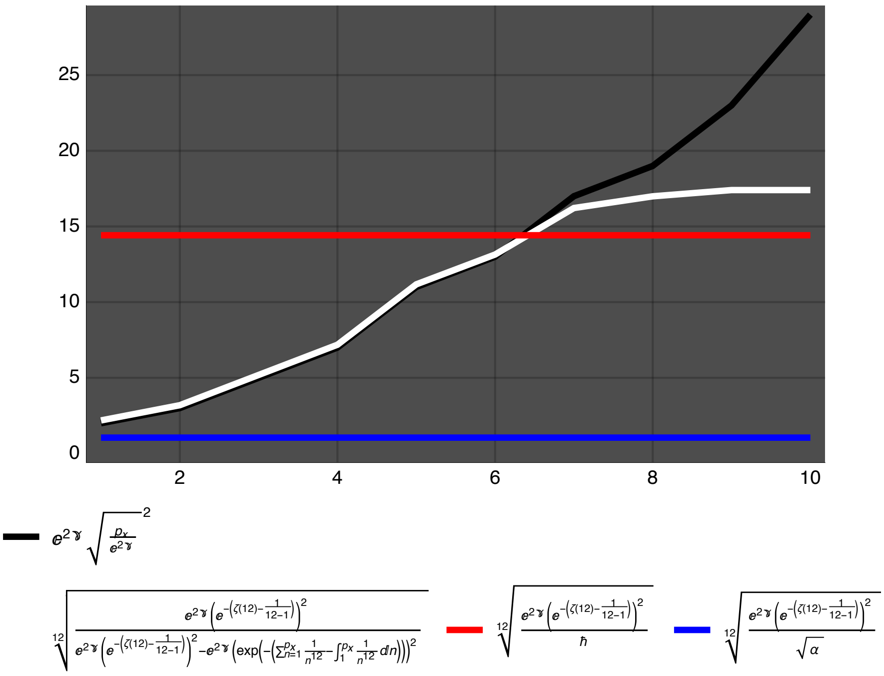
Where the traditional equation fails by implying that an energy source located at the center of this area unit-circle is undiminished from center to circumference (it has either a zero or an infinite radius), the second provides us with a potentially infinite hierarchy of energy levels that are necessarily non-infinite and non-zero. Given that γ is a spacial case of $\zeta(s) - \frac{1}{s-1}$ for s =1, we can go from $\lim_{x\to\infty} e^{2\gamma} \sqrt{\frac{1}{e^{2\left(\sum_{n=1}^{x}\frac{1}{n}-\int_{1}^{x}\frac{1}{n}dn\right)}}}^{\,2} = 1$ to the more general:

$$\lim_{x\to\infty} e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}\left(\left(\frac{1}{\exp\left((s+1)\left(\sum_{n=1}^{x}\frac{1}{n^s}-\int_{1}^{x}\frac{1}{n^s}\,dn\right)\right)}\right)^{\frac{1}{s+1}}\right)^{s+1} = 1$$

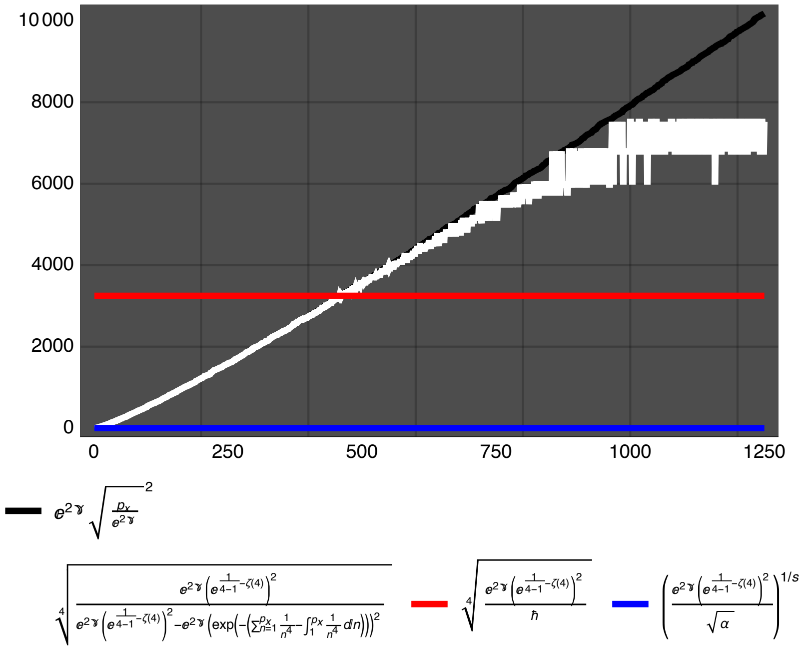
which -by reference to s = 12- is how we arrived at the proposed understanding of the fine-structure constant. Extending α as

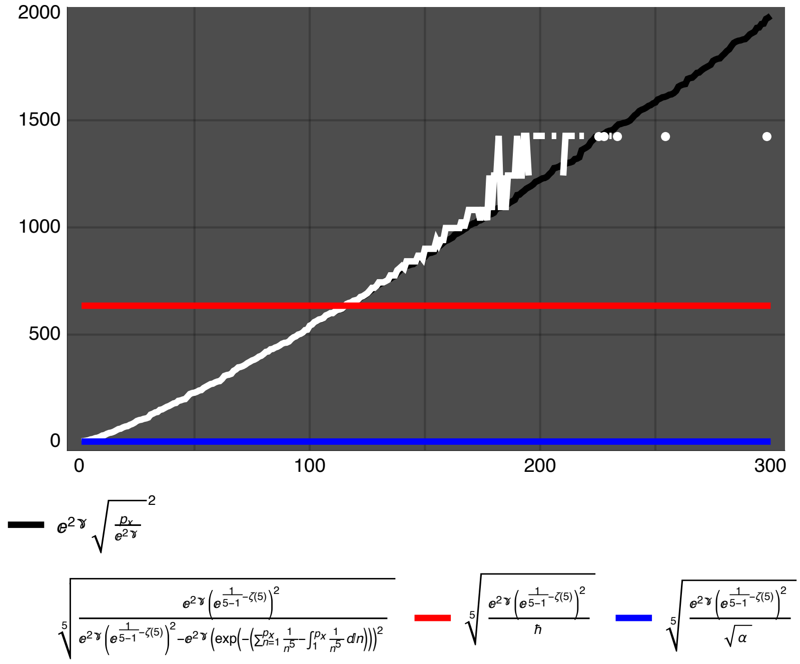
$$\alpha = \left(e^{2\gamma}\left(e^{-\left(\zeta(s)-\frac{1}{s-1}\right)}\right)^{2} - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1}{1^s}-\int_{1}^{1}\frac{1}{1^s}\,dn\right)}\right)^{2}\right)^{2}$$

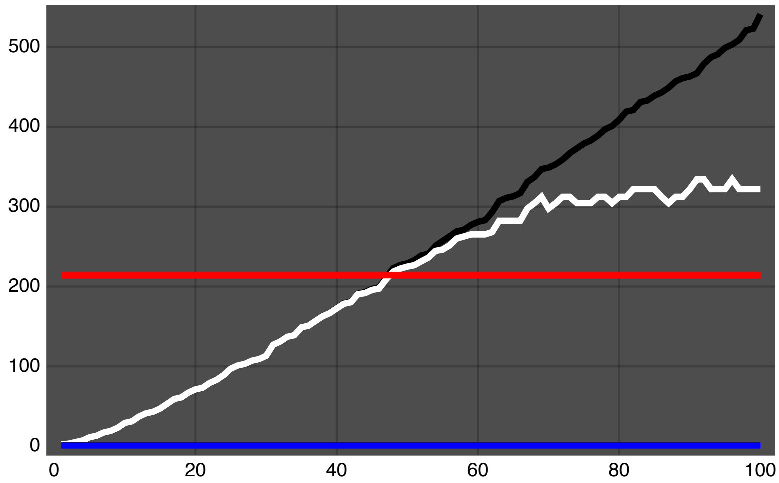
where s is a positive integer, we see that it possible to identify the fundamental physical constants as we know them from observation with a cross-section of the number line having a minimum and maximum size given at the one extreme by a dimensionless quantity whose size is reminiscent of the reduced Planck constant and at the other by the fine-structure constant:



It is noteworthy that there are a potentially infinite number of these cross-sections, each associated to a different (positive) real value of s and to a different set of constants:







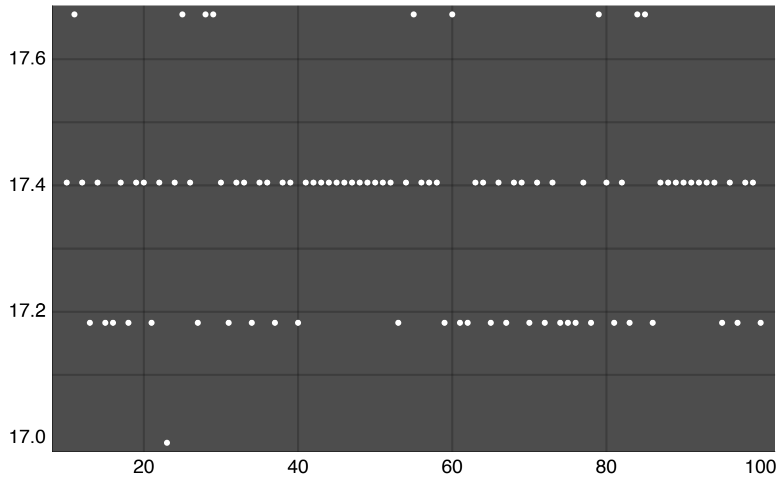
$$e^{2\gamma}\sqrt{\frac{p_x}{e^{2\gamma}}}^{\,2}$$

$$\sqrt[6]{\frac{e^{2\gamma}\left(e^{\frac{1}{6-1}-\zeta(6)}\right)^2}{e^{2\gamma}\left(e^{\frac{1}{6-1}-\zeta(6)}\right)^2-e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{p_x}\frac{1}{n^6}-\int_1^{p_x}\frac{1}{n^6}\,dn\right)\right)\right)^2}}$$

$$\left(\frac{e^{2\gamma}\left(e^{\frac{1}{6-1}-\zeta(6)}\right)^2}{\hbar}\right)^{1/s}$$

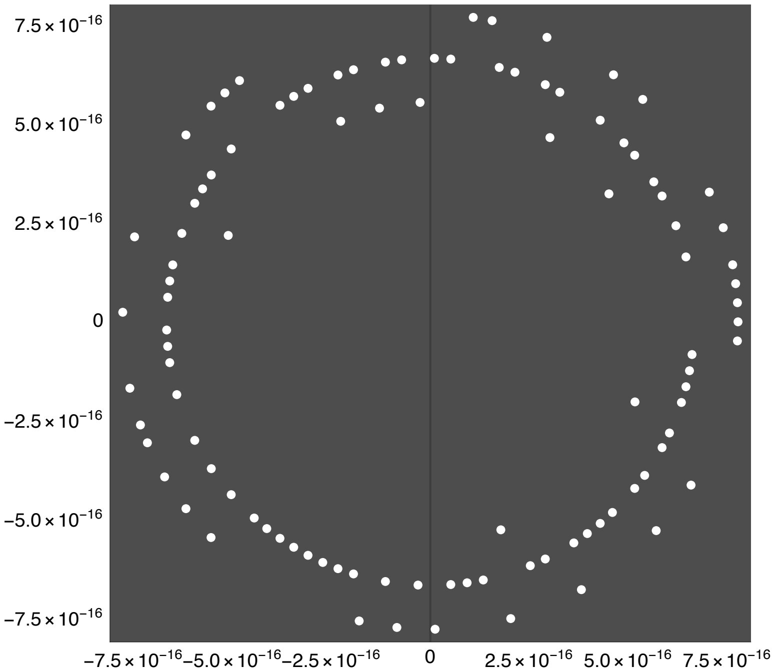
$$\left(\frac{e^{2\gamma}\left(e^{\frac{1}{6-1}-\zeta(6)}\right)^2}{\sqrt{\alpha}}\right)^{1/s}$$

If we look beyond what we can for now call the "Planck radius" in the case of $s = 12$, we see the following series of quantized jumps goes on forever within bounds prescribed by the Gibbs constant:



$$\sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2-e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{p_x}\frac{1}{n^{12}}-\int_1^{p_x}\frac{1}{n^{12}}\,dn\right)\right)\right)^2}}$$

A polar plot of the denominator alone on the narrow side of the Planck radius:



Since it is the differences between the partial sums/integrals and the limit that protect against the degeneration of a cosmic spiral into a circle with no radius (a point), or the degeneration of this spiral into a circle with *infinite* radius (a line), we know that these differences have minimum and maximum sizes. More particularly, we know that if and only if $s = 1$ and

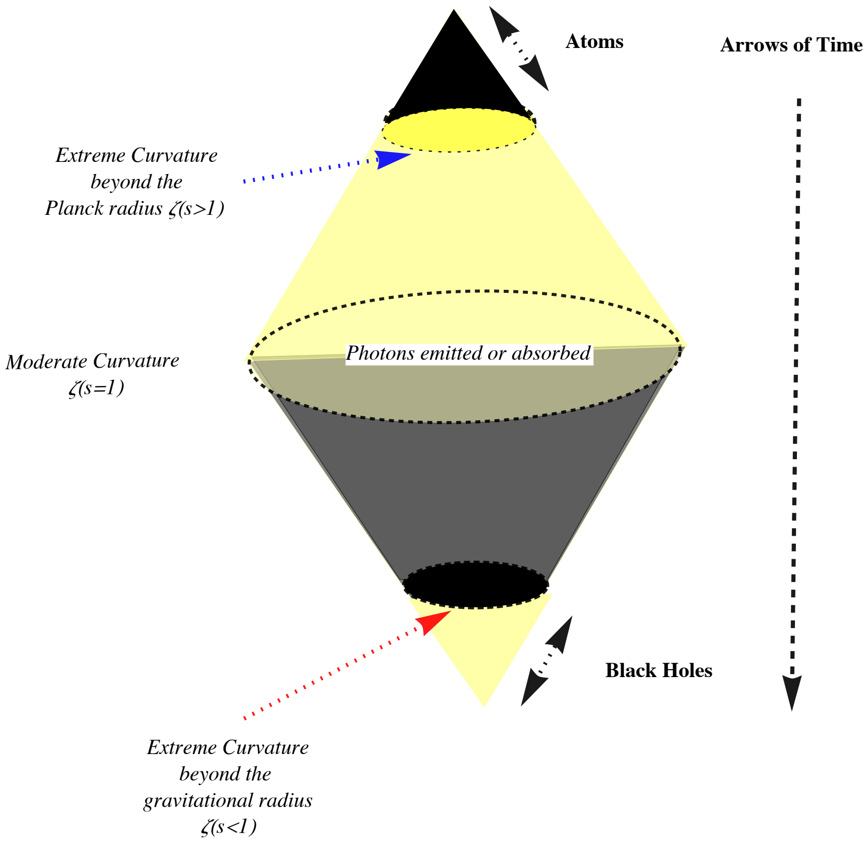
$$e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}\left(\left(\frac{1}{e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}}\right)^{\frac{1}{s+1}}\right)^{s+1} = e^{2\gamma}\sqrt{\frac{1}{e^{2\gamma}}}^{\,2} = 1$$

then the progression associated to

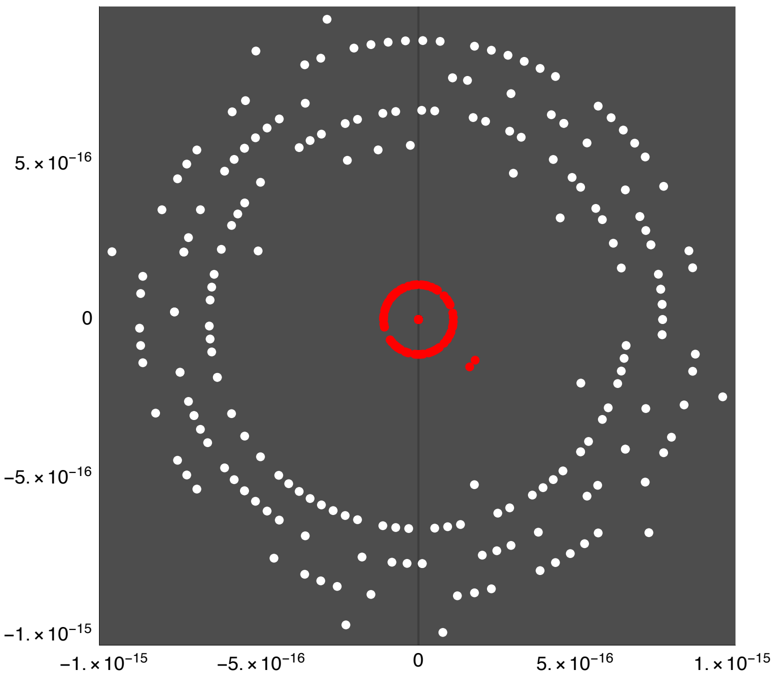
$$\left(\frac{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2}{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2 - e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{x}\frac{1}{n^s}-\int_1^x\frac{1}{n^s}\,dn\right)\right)\right)^2}\right)^{1/s}$$

is potentially infinite (in the case of $s = 1$, the difference between the partial sum/integral is always larger than the Planck radius). If s is a positive real number *greater or less than 1*, then the difference is sometimes equal or less than the Planck radius where s > 1, and in both cases the progression is strictly finite. These two directions leading away from $s = 1$ give us two distinct notions of imbalance, and of curvature. If $s > 1$, then the imbalance is in favour of light, and if $s < 1$, the imbalance is in favour of space.

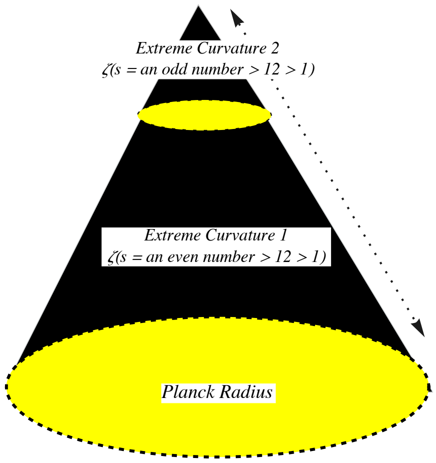
We might therefore model the electromagnetic and gravitational interactions (the nuclear interactions inclusive) in this way:



Combining polar plots of s = 12, 14, (white) and s = 13, 15, (red) shows that there is a still deeper level:



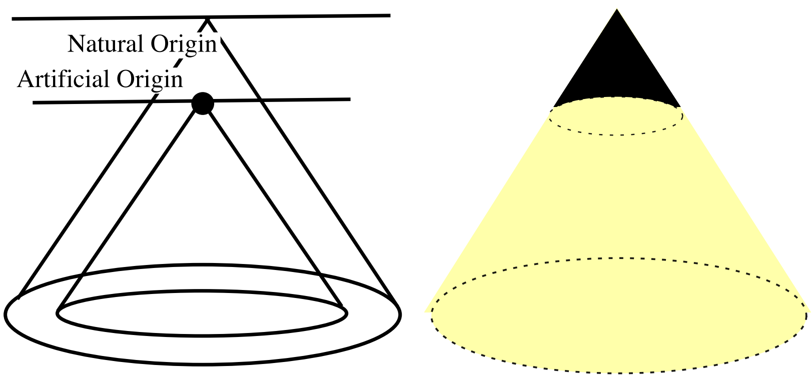
This data invites the following extension:



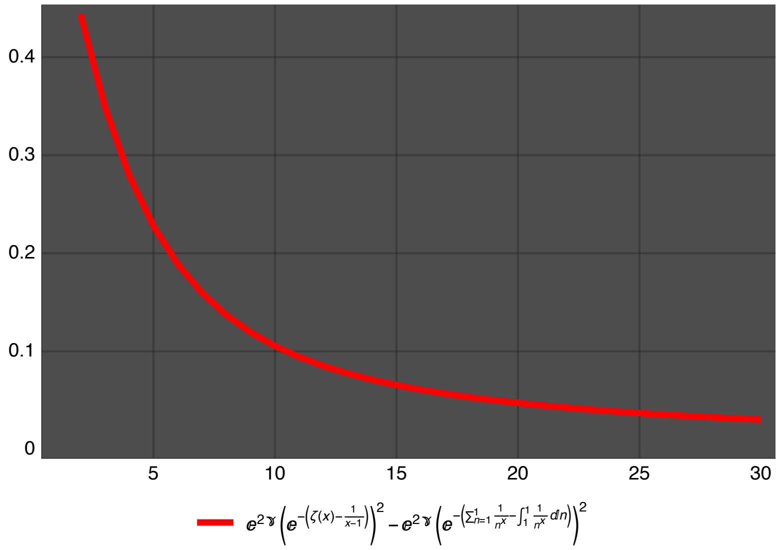
Wolfram Mathworld defines a projection in this way:

A projection is the transformation of points and lines in one plane onto another plane by connecting corresponding points on the two planes with parallel lines. This can be visualized as shining a (point) light source (located at infinity) through a translucent sheet of paper and making an image of whatever is drawn on it on a second sheet of paper. “

But a "(point) light source" is the same thing as a zero-dimensional light source, which involves the infinite concentration and the zero diffusion of light. The problem with the Wolfram Mathworld definition of projection, and with every physical theory that relies on multiple zero-dimensional point-sources, is that these involve an infinite concentration and zero diffusion of light, when in our experience light is always finitely concentrated/diffused. The solution -and the theory proposed here- is that the universe is a (holographic) projection arising from combinations of artificial atomic point sources such that the gaps between the natural and artificial sources correspond to angles and positions of the planes that allow for light to arise from a finite concentration and to undergo non-zero diffusion according to the equation $\lim_{x\to\infty} e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}\left(\left(\frac{1}{\exp\left((s+1)\left(\sum_{n=1}^{x}\frac{1}{n^s}-\int_1^x \frac{1}{n^s}\,dn\right)\right)}\right)^{\frac{1}{s+1}}\right)^{s+1} = 1$, an equation within which the fundamental physical constants are encapsulated.



Where the present universe is on this theory associated to units of a particular size, to a particular set of constants, and to particular arithmetic/spatio-temporal -for want of a better term- “dimensions”. A plot of $\sqrt{\alpha} = \left(e^{2\gamma}\left(e^{-\left(\zeta(s)-\frac{1}{s-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1}{1^s}-\int_1^1\frac{1}{1^s}\,dn\right)}\right)^2\right)$ shows that these dimensions differ radically



but the key, unifying, feature of the theory is that the balance of prime/energy-density of the units belonging to each dimension is constrained by the value $s = 1$, and by the limit $e^{2\gamma}\sqrt{\frac{1}{e^{2\gamma}}}^{2} = 1$, and therefore by the balance of prime-density and sparsity associated to complex zeros of L-functions if and only if the real part of these zeros is equal in every case to 1/2 (the Generalized Riemann Hypothesis) (9). This most fundamental of constraints ensures that the progressions associated to these units involve a potentially infinite number of primes: let g = Graham's number (11-12) (if every digit in Graham's number is considered to occupy as little as 1 Planck volume, it would nonetheless be too big to fit in the observable universe) and note that if s in the limit $e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}\left(\left(\frac{1}{e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}}\right)^{\frac{1}{s+1}}\right)^{s+1}$

differs from 1 by as little as

$$1^{-g}$$

the number of primes in the progression associated to $\left(\frac{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2}{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2-e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{x}\frac{1}{n^s}-\int_1^x\frac{1}{n^s}\,dn\right)\right)\right)^2}\right)^{1/s}$ is finite. This mathematics extends the inverse square law beyond the arithmetically continuous classical domains in which there is a balance of energy-density and sparsity by regarding non-classical regions as sub or super-domains. Note that where s > 1 the traditional value of π (written as $e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}$ where $s = 1$) is effectively distorted in a positive direction, thereby distorting the dimensions of a circle in a certain direction. Where s < 1, this value is distorted in a *negative* direction, also distorting the dimensions of a circle. In the one case, there is an imbalance of energy and space in favour of energy, while in the other, the imbalance is in favour of space. If we take the unit within which the fundamental physical constants are encapsulated and attach it to the $\frac{S}{\pi r^2}$ equation like this:

$$S = \sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{x}\frac{1}{n^{12}}-\int_1^x\frac{1}{n^{12}}\,dn\right)}\right)^2}}$$

$$\frac{S}{\pi r^2} \approx \lim_{x\to\infty}\frac{S}{e^{2\left(\sum_{n=1}^{x}\frac{1}{n}-\int_1^x\frac{1}{n}\,dn\right)}r^2} = \frac{S}{e^{2\gamma}r^2}$$

we see that, while the classical objects ($s = 1$) that are the “flux” of this energy system are governed by the inverse square law, and the non-classical objects (s ≠ 1) that are the *sources of this flux* are not, both are nonetheless governed by the same equation.

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